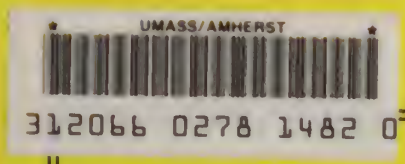
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Guide to Contamination Sources For Wellhead Protection

A Cape Cod Aquifer Management Project (CCAMP) Document

February 1989

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CAPE COD PLANNING AND ECONOMIC DEVELOPMENT COMMISSION

IN COOPERATION WITH:

THE TOWN OF BARNSTABLE AND THE TOWN OF EASTHAM

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GUIDE TO CONTAMINATION SOURCES FOR WELLHEAD PROTECTION

by

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February 1989

Sponsored by the Cape Cod Aquifer Management Project (CCAMP), a comprehensive groundwater protection project conducted by the Massachusetts Department of Environmental Quality Engineering (DEQE), U.S. Environmental Protection Agency Region I (USEPA), the Cape Cod Planning and Economic Development Commission (CCPEDC) and the U.S. Geological Survey (USGS). Partially funded by the DEQE, Division of Water Supply, Water Supply Contamination Correction Program.

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Table of Contents

Preface i

I. Introduction

Background and Description of Guide 1
Purpose 1
Use of Guide 1

II. Wellhead Protection 4

Public Well Closures in Massachusetts 6

III. Groundwater

The Hydrologic Cycle and Groundwater 8
The Water Table 9
Aquifers 9
Groundwater Movement 14

IV. Public Supply Wells

Cone of Depression 15
Zone II Areas and Groundwater Contamination 16

V. Description of Properties and Processes Affecting the Fate of Contaminants in Soils and Aquifers..... 20

Volatilization 20
Viscosity 20
Density (Solution Density) 20
Solubility 22
Dispersion and Dilution 22
Biodegradation 22
Hydrolysis 23
Ion Exchange 23
Sorption 25

VI. Description of Contaminants

Acids and Bases 26
Chloride 27
Fluoride 28
Heavy Metals 28
Iron and Manganese 30
Nitrates 31
Pathogens/Viruses 32
Pesticides 34
Petroleum Products 37
Phenols 40
Radioactivity 40

Sodium 42
Solvents 42
Sulfate 45
Surfactants (Detergents) 45

VII. **Massachusetts Hazardous Waste Manifest System**

Classification of Hazardous Waste 47
Hazardous Waste Generator Status 49
Accumulation Area Standards..... 49
Standards for Containers and Tanks..... 50

VIII. **Waste Oil**

Generator Status 51
Operating Requirements for Underground Tanks Storing Waste Oil..... 51
Testing Requirements..... 52
Design Standards..... 53

IX. **Description of Land Use Categories**

Agriculture/Golf Courses 55
Airports 61
Asphalt Plants 66
Boat Yards/Builders 70
Car Washes 74
Cemeteries 76
Chemical Manufacture 80
Clandestine Dumping 88
Dry Cleaning 90
Furniture Stripping/Painting 94
Hazardous Materials Storage and Transfer 98
High Technology Industries 103
Lagoons and Pits 106
Jewelry and Metal Plating 108
Junkyards 112
Landfills 115
Laundromats 121
Machine Shops/Metal Working 122
Municipal Wastewater and Sewer Lines 127
Photography Labs/Printers 129
Railroad Tracks and Yards/Maintenance Stations..... 133
Research Labs/Universities/Hospitals 135
Road and Maintenance Depots 138
Sand and Gravel Mining/Washing 148
Septage Lagoons and Sludge 150
Septic Systems and Water Softeners 152
Stables, Feedlots, Kennels, Piggeries, and Manure Pits 161
Stormwater Drains, Retention Basins 162

Stump Dumps 167
Underground Storage Tanks (USTs) 168
Vehicular Services 175
Wood Preserving 180

X. **Local Regulatory Techniques**

Methods for Protecting Areas Important to Groundwater Supplies 181
Zoning 184
Examples of Activities and Uses Regulated by Zoning Bylaws 185
Local Bylaws or Ordinances 187
Subdivision Regulations 190
Boards of Health 191
Planning Boards 196
Conservation Commissions 198

XI. **Glossary** 200

XII. **Bibliography** 203

XIII. **Matrices** 207

Land Use/Public Supply Well Pollution Matrix
Land Use/Local Regulatory Techniques Matrix

Appendices

A. Technical References for Protecting Groundwater from Hazardous Materials and Other Contaminants A-1
B. Summary of Massachusetts Drinking Water Quality Monitoring Program B-1
C. Emergency Regulations - Site Assignment for Solid Waste Facilities, Department of Environmental Quality Engineering, 310 CMR 16.00 ..... C-1
D. Examples of Local Bylaws D-1
E. DEQE Water Supply Technical Assistance Program for Groundwater Communities E-1
F. Cape Cod Aquifer Management Project (CCAMP) Documents Available F-1

PREFACE

This Guide was produced by the Cape Cod Aquifer Management Project (CCAMP) and is intended to provide guidance to local officials, planning boards, conservation commissions, boards of health, water purveyors, and state officials for evaluating land uses in recharge areas for public water supply wells. The Guide can be used in an inventory of ground water contaminant sources to target the investigation on sources posing the greatest threat to ground water. The Guide can also be used to determine whether certain land uses should be regulated within a wellhead area and what types of design and operating controls may be appropriate for land uses that are allowed.

More specifically, the Guide describes common land uses that may threaten ground water in wellhead protection areas and recommends strategies for addressing such threats. The document describes a wide range of commercial products and activities that are associated with releases of hazardous substances to soil and ground water. In addition, it contains information on the best management practices for each land use which, if implemented, can minimize the threat to ground water.

The remainder of this introduction briefly describes the activities undertaken as part of CCAMP, summarizes EPA's Wellhead Protection Program, and explains how CCAMP in general and this Guide in particular relate to the objectives of the Wellhead Protection Program.

CAPE COD AQUIFER MANAGEMENT PROJECT

The Cape Cod Aquifer Management Project was initiated in 1985 to develop a comprehensive, resource-based approach to ground water protection.[1] The Cape Cod Planning and Economic Development Commission, the Massachusetts Department of Environmental Quality Engineering, the U.S. Environmental Protection Agency, and the U.S. Geological Survey joined with two Cape Cod communities, Barnstable and Eastham, to conduct this innovative two-year project. With cooperation from all levels of government, CCAMP serves as a model for a comprehensive approach to ground water protection and provides many useful lessons that are likely to apply to other areas.

CCAMP's basic premise was that ground water protection must be based on the characteristics of the resource itself. The most vulnerable portions of the resource in need of protection must therefore be identified by delineating the wellhead area which contributes recharge to a well. Delineation of a wellhead area is not always straightforward, but may be a technically challenging task dependent on the specific features of the aquifer and pumping rates.

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[1] Additional information on CCAMP may be found in The Cape Cod Aquifer Management Project Executive Summary, EPA 901/3-88-003.

Once the wellhead area is delineated, appropriate strategies for management of contaminant sources can then be focused in these areas. Effective management requires a well integrated approach with a strong scientific base for regulatory decision making. A key feature of CCAMP was the cooperation of scientists, policy analysts, and program managers at all levels of government. The project work groups evaluated and refined hydrogeologic data and scientific methodologies for defining and protecting wellhead protection areas. These analyses were incorporated into an examination of the institutional framework for protection.

Cape Cod was an ideal location to undertake this project. The Cape is blessed with an abundance of high quality water, yet the sandy soils that provide plentiful recharge to the underlying aquifer also permit easy access for contaminants. There have been a few widely publicized occurrences of contamination and numerous smaller incidents. The continued influx of both summer and year round residents accompanied by increased economic activity will present an ever greater threat of further contamination. Several communities, including Barnstable, have recognized the potential risk posed to their wells and have instituted aggressive ground water protection programs including acquisition of over 774 acres of vulnerable land and implementation of local ordinances. Eastham differs from Barnstable because it is far more rural in character, is dependent on private wells facing different types of threats, and has limited full-time government staff for addressing ground water protection. Thus, Cape Cod communities presented a range of circumstances and situations which were common among many communities in New England and elsewhere. Additionally, Cape Cod has a strong regional identity including a high degree of public awareness surrounding ground water resources.

WELLHEAD PROTECTION PROGRAM

At the time when CCAMP began, its broad, resource-wide perspective on ground water represented an innovative and somewhat uncommon approach to the management of ground water. After CCAMP was initiated, Congress embraced a similar perspective when it reauthorized the Safe Drinking Water Act to include provisions for a new ground water protection program designed to protect public drinking water supplies from contamination. The Wellhead Protection Program was envisioned to be a nationwide, comprehensive, and systematic approach to encourage states to protect vulnerable wellhead areas. Unlike many ground water programs, the primary goal of the Wellhead Protection Program is to prevent contamination problems instead of correcting existing situations.

Congress recognized that ground water resource protection, unlike programs for other environmental media, is inextricably linked to local government authorities. Consequently, they chose to design a program in which the federal presence was minimal and primary responsibilities lay with state and local entities. EPA's role in the Wellhead Protection Program is to provide leadership, guidance, and support to state, regional, and local

organizations in the form of monetary grants and technical guidance; the Wellhead Protection program does not create an additional layer of federal regulation. States are encouraged to consider their own needs and constraints and to build on existing programs, relationships, and understanding to develop the wellhead protection program suited for their state.

Although there is a wide latitude in individual state programs, in order to ensure minimal consistency nationwide, Congress did identify six key elements which should be an integral part of any wellhead protection system. Grant applicants are required to address each of these seven elements as a prerequisite for receiving funds. These elements include:

- Specify the duties of state and local agencies and public water systems in developing and implementing the program.
- Determine the extent of the wellhead areas.
- Determine all potential anthropogenic (man-made) sources of contamination.
- Describe procedures to protect water supplies from these contaminants.
- Include contingency plans for the provision of alterative drinking water supplies.
- Consider potential sources of contamination in areas of future wells prior to construction.
- Develop a public participation program.

CCAMP AS AN EXAMPLE OF THE WELLHEAD PROTECTION PROGRAM

Although CCAMP was not originally undertaken in response to the Wellhead Protection Program, CCAMP meets many of the requirements of the program and is a good example of an effective approach to ground water protection. Key similarities between CCAMP and the Wellhead Protection Program include the adoption of a resource-based approach to protection, the recognition of a role for all levels of government, and the integration of the results of scientific analysis and program management considerations in protection efforts. Over the two-year project, CCAMP addressed most of the elements identified in the Wellhead Protection Program.

Implementation Roles and Responsibilities: Throughout the two-year span of the project, program managers representing each of the participating agencies and communities met to examine the institutional framework for ground water protection. The entities involved in ground water management were identified as were their appropriate roles and responsibilities. Based on

this analysis, recommendations were made to strengthen protection, improve consistency, and enhance coordination.

Wellhead Delineation: Prior to CCAMP, the wellhead protection areas surrounding public supply wells on Cape Cod were delineated using relatively simple analytic models. A cooperative research project between the U.S. Geological Survey, the State of Massachusetts and the Cape Cod Planning and Economic Development Commission is currently underway to develop and apply more sophisticated three-dimensional ground water models to determine wellhead protection areas. These models are being applied in a variety of complex hydrogeologic settings and will be compared to the results of the simpler models.

Source Inventory: A major part of the CCAMP was a land use survey that identified all potential sources of contamination in the wellhead protection areas. In order to locate specific land uses most accurately, tax assessors maps which outline each individual parcel were utilized. Every business was identified on each parcel, and a computer file was created referencing the business to the parcel. Data files collected as part of both local and state regulatory programs were searched, automated, and plotted on a map. Subsequent analyses based on these data, using a geographic information system, enabled CCAMP to design specific management recommendations targeted at the very specific issues facing the local wellhead area.

Management of Contaminant Sources: Based on the land use study, CCAMP was able to evaluate the present state of ground water management in Barnstable. As a result, CCAMP identified many potential contaminant sources which were unregulated. CCAMP recognized the need for local ordinances to provide regulation in situations not addressed by state requirements and identified a need for a strong inspection and enforcement program. CCAMP recommended that the state increase and better coordinate enforcement efforts and also suggested that state permitting programs adopt a resource-based approach and place enforcement priorities within wellhead areas.

Development of New Wells: The Town of Eastham has no public water system and depends on private wells. Due to increased growth and the resulting potential to render private wells undrinkable, Eastham requested that CCAMP undertake an analysis to identify future public water supply sites. An overlay procedure was employed; first, large town owned land parcels were identified and then potentially contaminating land uses were overlaid. These land uses were plotted on a map with a surrounding buffer zone to ensure that any new well site would be a reasonable distance from potential sources of contamination. Because this new site was in a less developed area, the threat of contamination was not nearly as great as in Barnstable. Nonetheless, CCAMP encouraged Eastham to institute protective land use regulations within the estimated wellhead protection area in order to avoid a future situation where, as in Barnstable, existing land use activities must be very carefully managed to avoid contamination of ground water.

USE OF THIS GUIDE IN A WELLHEAD PROTECTION PROGRAM

CCAMP undertook a number of activities that suggested a need for a document like the Guide to Contaminant Sources. In conducting the land use inventory, CCAMP participants had to determine whether the particular land use taking place on each parcel of land posed a threat to ground water. CCAMP spent a significant amount of time working with local officials to study specific land uses to assess the threat to ground water. Once potential contaminant sources were identified, CCAMP participants had to consider methods for limiting the threat to ground water from each source. The way in which the threat is created, the available options of controlling the threat, and existing regulations vary widely depending on the particular land use. Consequently, CCAMP devoted substantial effort to developing a set of standards, or best management practices, which if implemented, would minimize the threat to ground water. Moreover, CCAMP demonstrated that local governments are likely to require technical assistance on complex issues related to source identification and development of best management practices.

For all of these reasons, the Guide to Contaminant Sources was prepared. While the Guide was developed specifically for use in the CCAMP effort, a special effort was made to examine a broad range of contaminant sources and best management practices. Because the document is meant to represent general conditions, it may prove to be a useful tool for the development of wellhead protection programs by other local, regional, and state entities. The Guide may be particularly useful for conducting source inventories within wellhead protection areas and in developing management methods for protecting ground water from contamination.

The Guide can be used to identify the threats to ground water located within a wellhead protection area. The Guide provides information on 16 ground water contaminants or classes of contaminants that merit special attention because of the potential for ground water contamination. The Guide also lists 32 common land use practices which are typically associated with the production, management, or disposal of a wide range of hazardous products or wastes. Finally, the Guide provides a number of examples of products that contain a particular contaminant and describes common uses of the product. The Guide, therefore, can play a key role in the inventory of contaminant sources within a wellhead area. The Guide can be used to improve the efficiency of the inventory process because its allows the inventory of contaminant sources to be targeted at those activities requiring some form of control and to disregard other activities which pose no threat to ground water.

Because it describes techniques for mitigating the threats to ground water created by each land use, the Guide can also be used in a wellhead protection program to define management approaches for wellhead areas. For each land use category, the Guide describes Best Management Practices (BMPs). BMPs generally define a set of standard operating procedures that can be used in a particular industry or commercial activity to limit the threat to the

environment posed by ongoing processes, such as pesticide application or the storage of hazardous waste in containers. These BMPs can be inserted directly into general by-laws, zoning by-laws, or other local regulations. BMPs can also be used as performance standards for special permits. The Guide also describes a variety of local regulatory tools that can be used to manage sources of contamination within wellhead protection areas. Such tools include zoning ordinances, subdivision controls, and the use of boards of health, planning boards, and conservation commissions.

In short, while the Guide was developed specifically in the context of the CCAMP effort, its broad overview of land uses that threaten ground water and its emphasis on practical techniques for mitigating contaminant threats make it a useful tool for the development of wellhead protection programs throughout the country.

Background

GUIDE TO CONTAMINATION SOURCES FOR WELLHEAD PROTECTION

I. Introduction

Background and Description of Guide

Through the combined efforts of scientists, engineers, planners and regulators representing the four agencies participating in the Cape Cod Aquifer Management Project (CCAMP) - The Cape Cod Planning and Economic Development Commission, the Massachusetts Department of Environmental Quality Engineering, the U.S. Environmental Protection Agency Region I and the U.S. Geological Survey's Massachusetts Office - the CCAMP Aquifer Assessment Committee initially developed the Guide to Contamination Sources for Wellhead Protection. The manual was subsequently expanded and completed with the financial support of the Massachusetts Department of Environmental Quality Engineering, Division of Water Supply. The Division will use the Guide as part of the Development of a Wellhead Protection Program for the State of Massachusetts under the 1986 Safe Drinking Water Act.

The Guide provides detailed information on 16 potential groundwater contaminants or classes of contaminants and 32 common land use categories. The Guide covers the threat each land use may pose to groundwater quality, key examples of the products that contain a particular contaminant, common uses of the product or contaminant and the behavior and mobility of the contaminant in the soils and groundwater. For each land use category, Best Management Practices (BMPs) are described. These BMPs can be inserted directly into general bylaws, zoning bylaws, board of health regulations or used as performance standards for special permits. The Guide provides background information on common land uses and contaminants for use in the development of scientifically based wellhead-protection strategies.

The Guide also includes a discussion of local regulatory techniques for groundwater and wellhead protection, including zoning, subdivision regulations, and health regulations. The descriptive sections of the guide are closely linked to two summary matrices which are presented as fold-in posters that are intended to be used as convenient reference sources. The first matrix, entitled the Land-Use/Public-Supply Well Pollution Matrix, indicates which of the 32 common land use categories assessed in the guide have the potential to release the 16 potential groundwater contaminants and to potentially contaminate a public-supply well. The second matrix, entitled the Land-Use/Local-Regulatory Techniques Matrix, shows which regulatory technique may be applicable for controlling the same list of 32 common land-use categories. Supporting material and references are presented in the appendices.

Purpose

The Guide provides essential information for use in development of local and State wellhead groundwater protection programs. It is also intended to provide guidance to several types of users. Local water suppliers will find the Guide helpful in ensuring that existing and potential public-water supplies do not become contaminated. It can be used in inspection of existing land uses in annual Groundwater Survey Reports, and in sanitary surveys of potential new sources through the New Source Approval Process. To support the increasing role in wellhead protection by local water suppliers. The Guide can also be used by such suppliers to review proposed developments in wellhead protection areas to ensure that un-necessary risks are not created. This use will help support the increasing role in wellhead protection by local water suppliers.

The second major planned group of users are local citizens and officials - representatives of planning boards, boards of health, and the like - with responsibilities for local land-use regulations. The Guide can help such officials make decisions on siting land uses (for example, determining which land uses should be regulated by local wellhead or aquifer protection overlay districts and in evaluating development proposals). It will also assist in evaluation and inspection of existing land uses for contamination threats, and could aid in investigating sources of groundwater contamination.

A final group of users are regional and State officials. Such officials may need to evaluate the impacts of a proposed development on groundwater or public-supply wells as part of an environmental impact review process.

How to Use the Guide

The Guide as a whole is designed to be used as a handbook and source for detailed information on a specific land use category or potential groundwater contaminant. The accompanying matrices provide a quick way of evaluating potential impacts of land uses and possible regulatory control techniques.

The Guide and Matrices are based on a literature review and the combined field experience of those who helped to prepare them. As such, they are somewhat subjective and meant to represent <u>general conditions</u>. The Guide is not intended to be exhaustive or final, but rather to provide a useful starting point in an area where detailed information is often hard to find. The land uses covered by the Matrices are those that could be found in the recharge area of a public water-supply well or wellfield. Land uses that would be considered heavy industry were not covered because each of these may be very complex, not easily generalized and warrant a closer, detailed examination.

It is difficult to assess the overall threat to groundwater from a particular land use. The actual threat presented by a particular land use depends upon several factors including:

(1) the type and quantity of chemicals used or wastes generated by the land use
(2) the storage and disposal methods practiced by the landuse
(3) site-specific characteristics of the soils and the aquifer
(4) distance to the public well or wellfield
(5) the behavior of the pollutants in the soils and groundwater

Additionally, there are always land uses that are the exception to any rule and may be using an unusual process involving chemicals not normally associated with that business. Thus, **the Guide and Matrices should be used only as an initial reference source.** They are not a substitute for looking at a particular land use in detail.

The current document is based on the best information available at the time of its preparation. Best Management Practices have not been listed for several land uses for which no data were available.

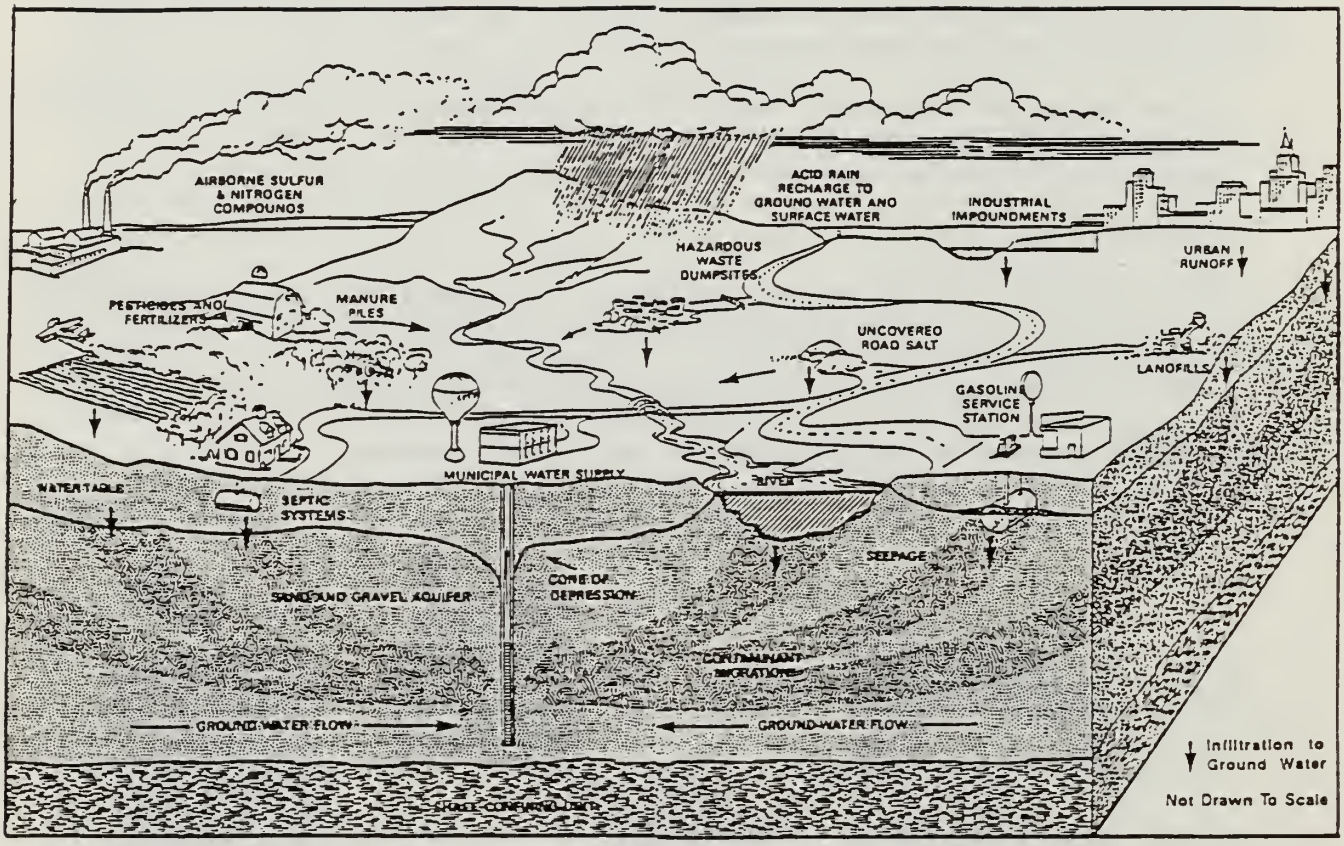
Comments on the Guide

Comments on both the content and format of the Guide from individuals who have used it would be very much appreciated. In particular, additional data om Best Management Practices for particular land uses would be quite useful. All comments should be sent to : Masachusetts Department of Environmental Quality Engineering, Division of Water Supply, One Winter Street, 9th floor, Boston, MA 02108, Atttention: Wellhead Protection Program Manager.



Some Common Land Uses That May Contribute Contaminants to Groundwater

SOURCE: U.S. Environmental Protection Agency, Office of Solid Waste, November 1986.



Potential Sources of Groundwater Contamination

SOURCE: U.S. Environmental Protection Agency, Office of Solid Waste November 1986.

Wellhead Protection

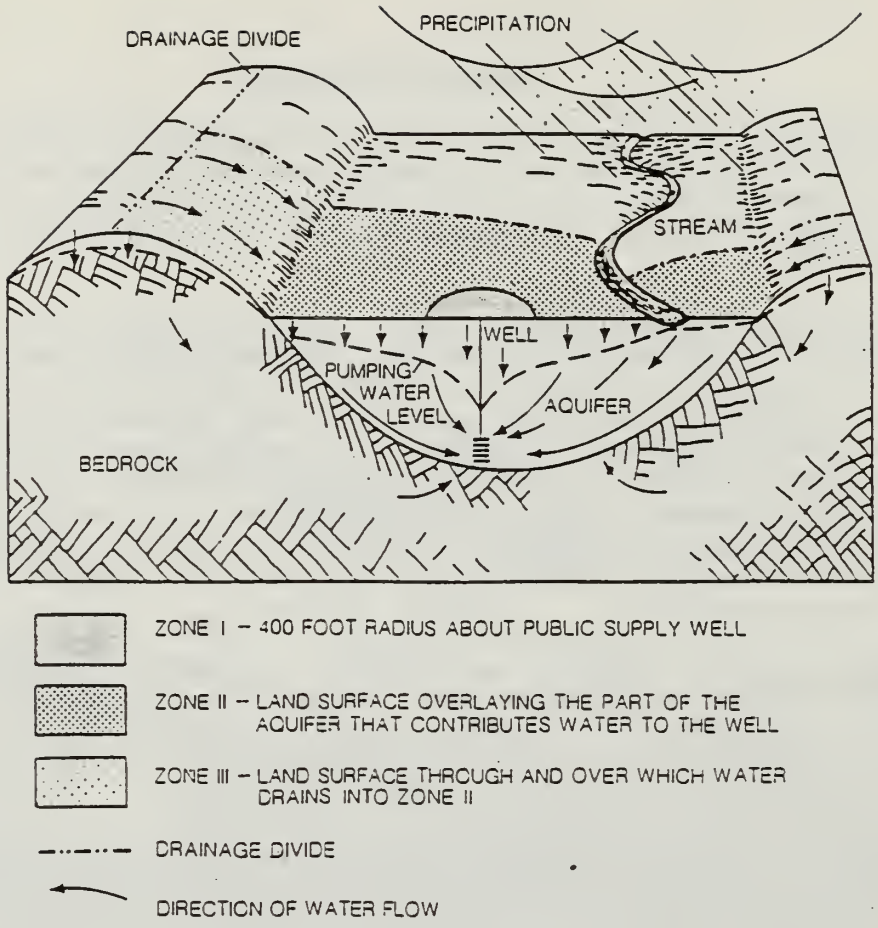
The amendments to the Federal Safe Drinking Water Act (SDWA) enacted June 19, 1986 established the Wellhead Protection Program to protect the nation's groundwater. This program focuses on controlling specific contaminants or sources of contamination in the recharge areas of public supply wells.

The term **wellhead protection area** is defined in the SDWA Amendments of 1986 as "the surface and subsurface area surrounding a water well or wellfield supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The law does not specify the precise delineation of the wellhead protection area; that is a site-specific determination. Four years prior to the SDWA Amendments, Massachusetts developed a similar program, the Aquifer Land Acquisition (ALA) Program, in response to increasing development pressure and the corresponding increase in threats to public drinking water supplies.

The strategy of the ALA Program is to: (1) define the primary recharge areas to public water supply wells - Zone II; (2) gather more detailed information on existing land uses within the Zone II of a public supply well; (3) reimburse eligible applicants for land acquired in the Zone II for water supply protection purposes.

The ALA regulations describe a "**zoned approach**" to groundwater supply protection. The Zones I, II, and III defined by the ALA Program are similar in concept to the **wellhead protection area** described in the SDWA Amendments. Zone I is the traditional 400' radius or other designated area around a public water supply well that a water supplier must own or control as required by DEQE Drinking Water Regulations (310 CMR 22.00) to protect the groundwater from microbiological contamination. The primary recharge area to a well, Zone II, is that area of an aquifer which contributes water to a well under the most severe recharge and pumping conditions that can be realistically anticipated. The boundaries of Zone II will be the groundwater divides which result from pumping the well and by the contact of the edge of the aquifer with less permeable materials such as till and bedrock. At some locations, streams and lakes may form recharge boundaries. Zone III is that upland area beyond the area of Zone II from which surface water and groundwater drains into Zone II.

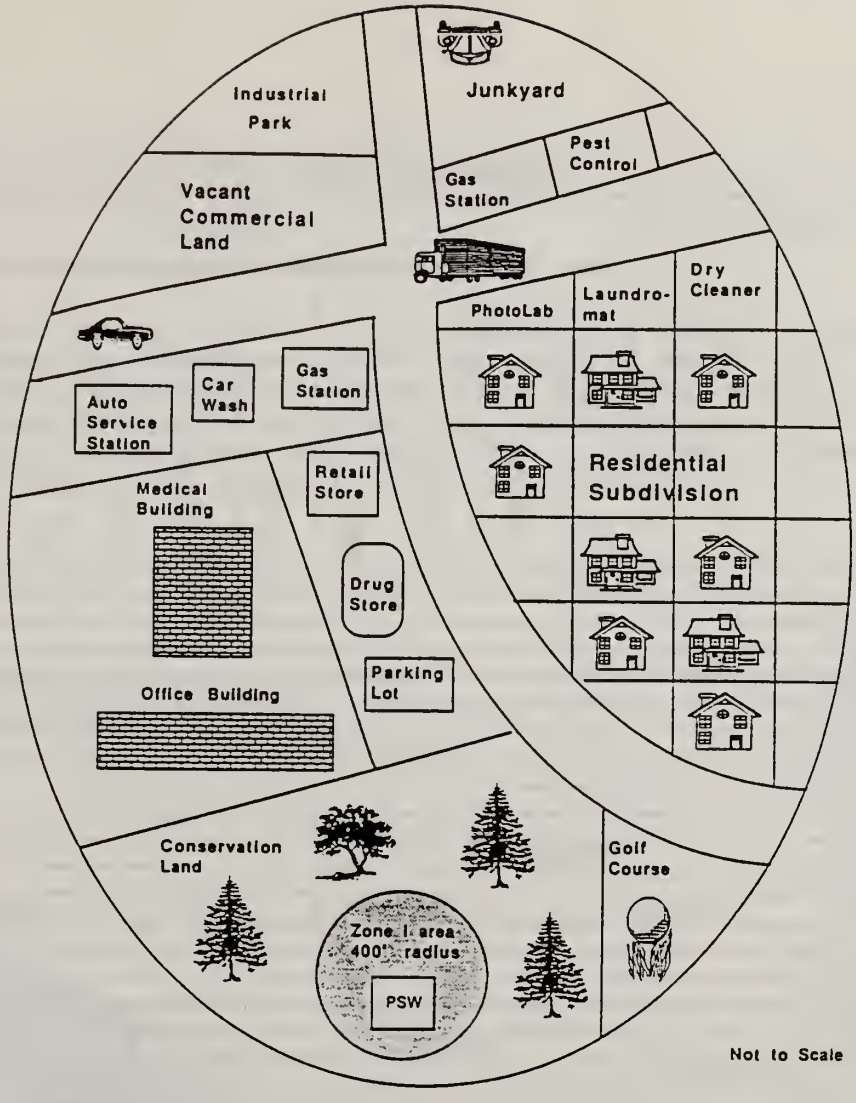
The delineation of Zones II and III is the first step towards developing a comprehensive groundwater protection program. Zone II is determined on a site specific basis based on specific guidelines issued by the DEQE. The Zone II area is **the most sensitive area of an aquifer from a groundwater supply (well) protection point of view** (DEQE, 1986).



Hydrogeologic Section of a Pumped Well in a Valley-fill Aquifer

SOURCE: Frimpter, Michael H., Donohue, John J., IV and Rapacz, Michael V., July 1988.

The following figure, entitled "Typical Land Uses in a Zone II Area", shows a public supply well, its Zones I and II, and some common land uses that could be found in a Zone II area. Since Zone II provides the primary groundwater recharge to a public supply well, any contaminants that infiltrate the soil and are not immobilized or attenuated in the soil will move down into the aquifer and travel with the groundwater that is flowing towards the well. Using the Matrix, local officials can easily check the various potential groundwater contaminants associated with products a particular business may use or wastes it may generate, and refer to the Guide for detailed information on the behavior and fate of a certain contaminant in the soils and groundwater. The information contained in the Matrix and Guide will aid local officials in determining those land uses that should be prohibited from Zone II areas or those that should be strictly controlled by local regulatory techniques such as Board of Health regulations, underground storage tank regulations or aquifer protection district bylaws.



Typical Land Uses in a Zone II Area
Kimberly D. Noake, October, 1987

Public Well Closures in Massachusetts

As of July 1986, forty communities in Massachusetts had lost a part or all of their municipal groundwater supplies to chemical and bacterial contamination (Special Legislative Commission on Water Supply, 1986). These contaminated municipal water supplies are a result of inappropriate land uses, either legal or illegal, located in the primary recharge areas (Zone II) of the wells. In the past, the use of the land in proximity to public supply wells (excluding the 400 foot protective radius required by the state) was not strictly controlled or monitored because the threats to the groundwater resource were not completely understood or the boundaries of the aquifer and well recharge area were not adequately delineated. However, current hydrogeologic assessment techniques and resource protection methods such as zoning and general bylaws, subdivision regulations and Board of Health regulations are available to enable communities to identify, define and protect existing and potential groundwater supplies. Conscious land use decisions must be made at the local level in order to protect groundwater supplies from contamination.

CONTAMINANTS AFFECTING MUNICIPALITIES

Municipality	Contaminant										
	Iron and Manganese	Coliform	Nitrates	MBAS	Phenols	Trihalomethanes	Salt	EDB	Petroleum Products	Organics	Others
Acton										X	
Amherst										X	
Ashland										X	
Auburn							X				
Bedford										X	
Braintree							X				
Brockton			X								
Burlington	X									X	
Canton										X	
Chatham									X*		
Danvers										X	
Dartmouth									X	X	
Dedham										X	
Deerfield								X			
Dighton										X	
Edgartown									X*		
Falmouth				X							
Groveland										X	
Holbrook										X	
Leicester									X		
Lowell	X										
Millis										X	
North Reading										X	
Norwood										X	
Oak Bluffs									X*		
Palmer										X	
Provincetown									X*		
Raynham									X		
Reading	X						X				
Rowley										X	
Scituate											**
Tewksbury	X	X			X	X				X	
Walpole									X		
Wareham	X										
Weston							X				
West Springfield								X			
Weymouth									X		
Wilmington										X	
Woburn										X	
Worcester		X									
Yarmouth							X				

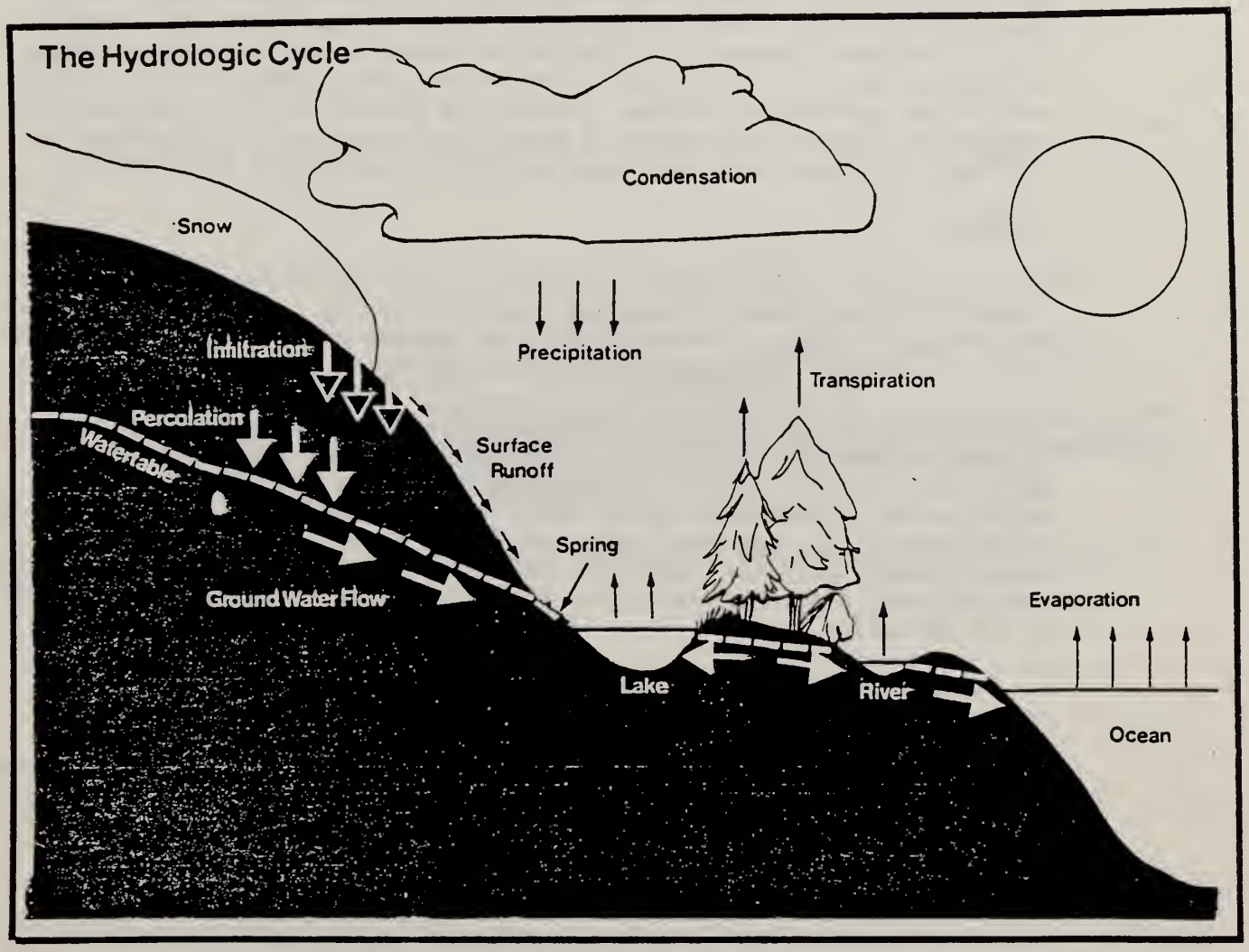
*supply threatened
**calcium carbonate

SOURCE: Special Legislative Commission on Water Supply, December 1986

III. Groundwater

The Hydrologic Cycle and Groundwater

The hydrologic cycle involves the continual movement or exchange of water between the atmosphere, the oceans and other surface water bodies and the land. Water vapor condenses in the atmosphere and falls upon the earth as precipitation. This water will either evaporate directly back to the atmosphere, travel over the land surface to streams or lakes where it then evaporates, or be absorbed by plants and transpired back to the



The Hydrologic Cycle

SOURCE: Metropolitan Area Planning Council, December 1983.

atmosphere. Any remaining water percolates down under the influence of gravity through the unsaturated zone where all the available pore spaces between soil and rock particles are partially filled with air and partially filled with water. In this zone, plants absorb some water, molecular and electrical forces bind some water to soil particles and some water is held by capillary tension. Any remaining water continues moving until it reaches the saturated zone, wherein water occupies all the available pore space between rock and soil particles. This water is **groundwater**.

The Water Table

An important hydrologic feature called the **water table** marks the top of the saturated zone. Everywhere along the surface of the water table hydrostatic pressure is equal to atmospheric pressure. Therefore the movement of the water is a function of elevation and water along the water table surface will always move from higher to lower elevations. This relationship helps to explain why the surface of the water table usually mirrors surface topography; rising below upland areas and dipping below topographic lows. Fluctuations in the water table elevation are a natural part of the groundwater system. Changes in elevation occur seasonally, in response to periods of drought or heavy precipitation or in response to artificial stresses such as a pumping well or wastewater infiltration.

Aquifers

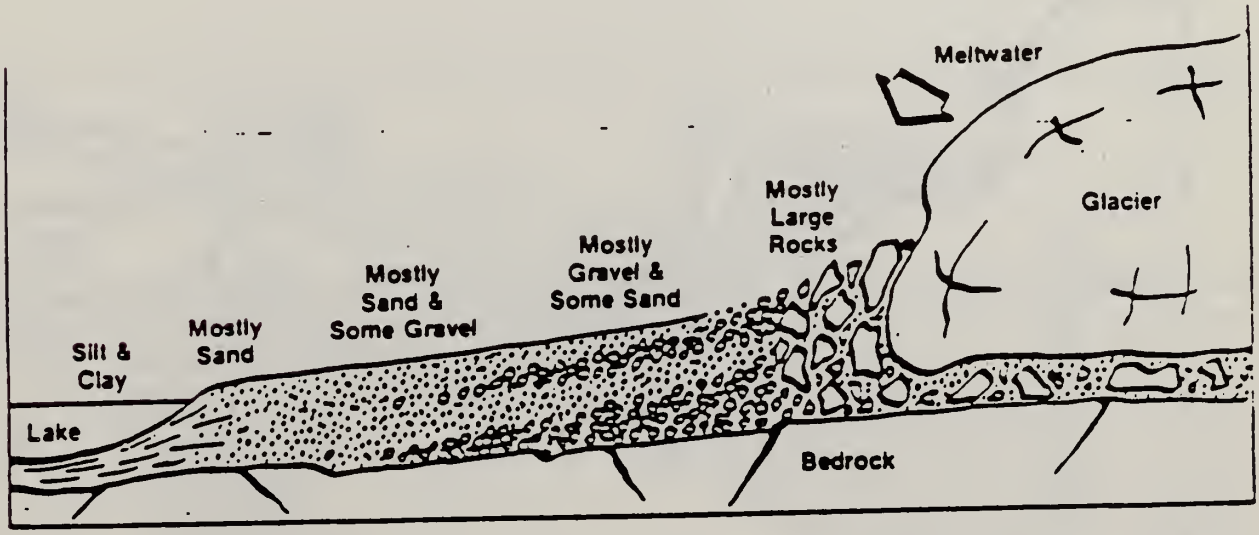
An aquifer is a geologic formation that can store, transmit and yield a significant quantity of water to a well or spring. The amount of water that can be stored and extracted from an aquifer depends upon a number of factors including the porosity and permeability of the aquifer materials.

The **porosity** of a specific geologic material describes its ability to hold groundwater. Porosity is dependent upon the proportion of void space (pore space) to total volume of the material and is usually expressed as a percentage of the total volume of pore space, i.e., 35% of a sand deposit is void pore space and 65% is solid material. In unconsolidated deposits (sand and gravels) pore space is found between the rock and soil particles and varies with the degree of sorting and the size of the particles.

Permeability is the ability of a material to transmit water. The permeability of an unconsolidated material depends upon the volume and size of pores as well as how the pore spaces are connected. There are three important characteristics of unconsolidated materials that influence permeability: (1) the size and shape of rock particles, (2) the degree of uniformity in the size and shape of the particles (sorting) and (3) the pattern in which the particles are packed.

Productive aquifer material must have both sufficient permeability and porosity. The unconsolidated sand and gravel deposits that supply groundwater to most of the Commonwealth's public supply wells are examples of highly porous, permeable aquifer materials.

In Massachusetts, the dominant aquifer materials are the surficial deposits (also referred to as unconsolidated deposits) deposited by the large glaciers that covered the state approximately 13,000 years ago. As the glacier advanced, it scraped and plucked large quantities of rock and soil from the land surface.

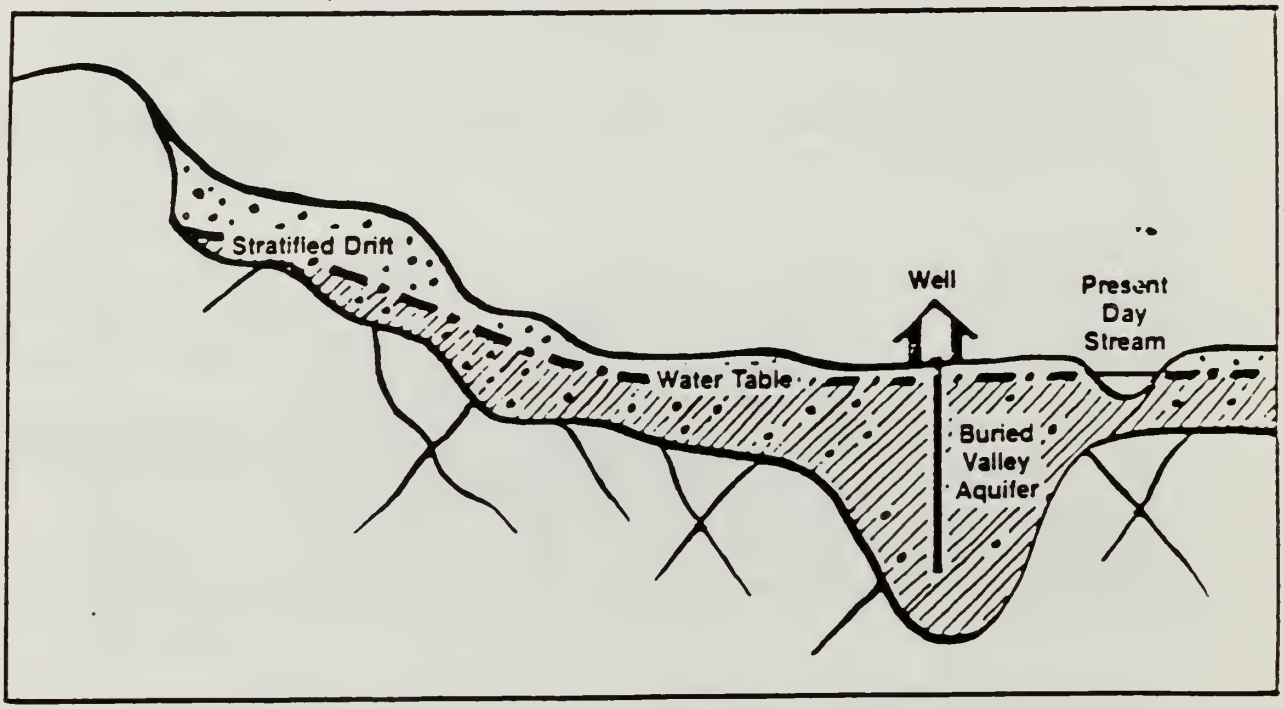


Glacial Meltwater and the Formation of Stratified Drift

SOURCE: Massachusetts Audubon Society, Groundwater Information Flyer #1, November/December 1983

When the glacier began to retreat, water from the melting ice sorted and deposited the gravels, sands, silt and clays held in the ice. These deposits were usually eroded, sorted and redeposited many times by flowing water, creating deposits known as **stratified drift.**

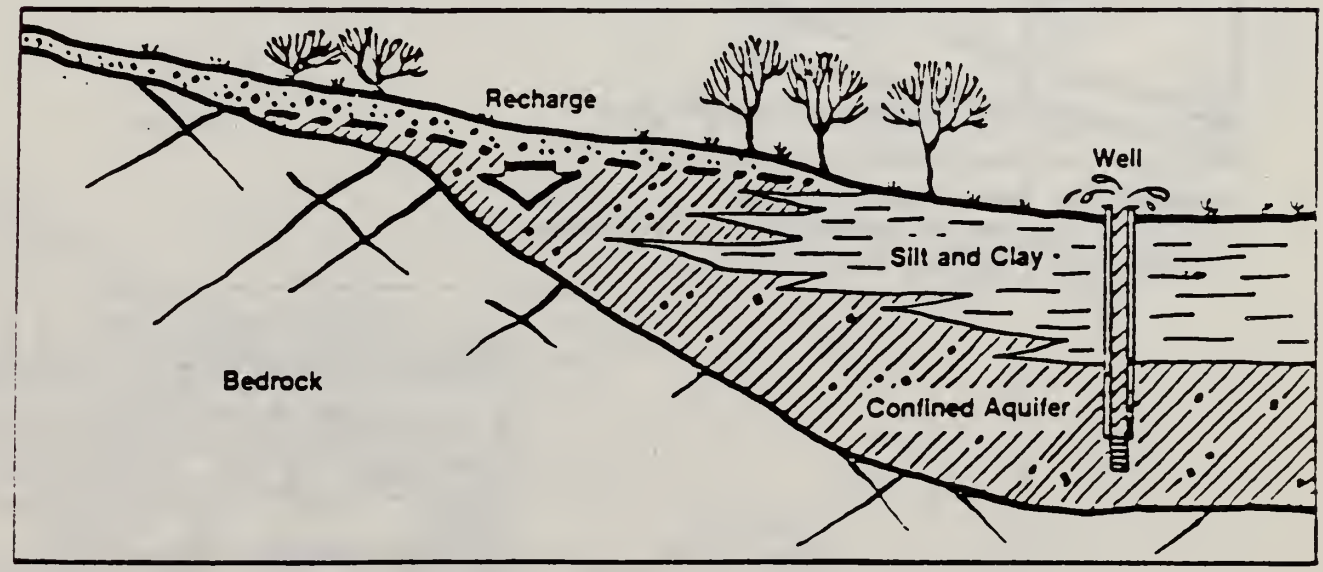
Glacial meltwater streams moving over pre-existing bedrock valleys left behind thick deposits of porous, permeable stratified drift in buried valley aquifers. As the glaciers melted and retreated, meltwater streams deposited stratified drift over the broad, low-lying area that is now southern Plymouth County, Cape Cod, Martha's Vineyard and Nantucket. These stratified drift deposits are called outwash plains. In Massachusetts, wells with the highest yields are located in buried river valley aquifers and outwash plain deposits.



An Ancient River Valley Filled With Stratified Drift.
These Buried Valley Aquifers are the Sites of
Most of the Public Supply Wells in Massachusetts

SOURCE: Massachusetts Audubon Society, Groundwater Information Flyer #1, November/December 1983.

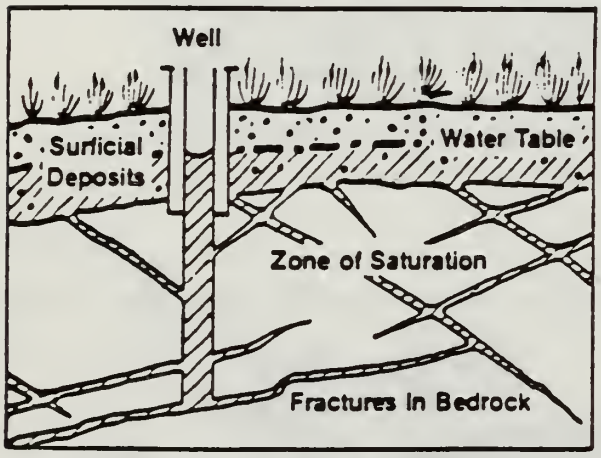
Confined aquifers, also known as artesian aquifers, are located between layers of material with very low permeability such as silt, clay or rock. Generally, little or no recharge to a confined aquifer comes from the confining layers. The primary recharge areas for confined aquifers occur where the aquifer intersects the land surface. These recharge areas may be located a considerable distance from the public supply well. Due to the presence of impermeable layers, the hydrostatic pressure of the groundwater in confined aquifers is greater than the atmospheric pressure. Consequently, when a well is placed in a confined aquifer, water will rise above the elevation of the upper confining layer. The pressure of the groundwater determines the elevation to which the water will rise. If a series of wells are placed in a confined aquifer and an imaginary line is drawn connecting the elevation of the water levels in all the wells, a potentiometric surface is delineated. For confined aquifers, the potentiometric surface is analogous to the water table in unconfined (water table) aquifers. The potentiometric surface may be above the land surface in some portions of the aquifer. Wells in these areas will flow freely and are generally called artesian wells.



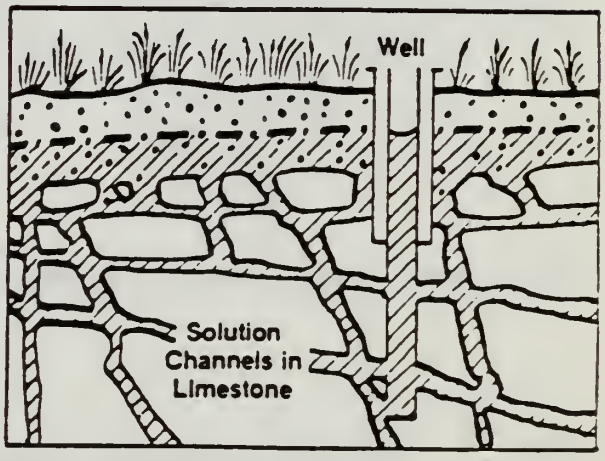
Confined Aquifers are Located Between Layers of Material That Have Very Low Permeability.

SOURCE: Massachusetts Audubon Society, Groundwater Information Flyer #1, November/December 1983.

Bedrock is the rock that underlies the soil and surficial materials. Groundwater is found in the cracks, fractures and faults that occur in bedrock. Bedrock wells that intercept highly fractured zones may yield a significant quantity of water. Groundwater moving through carbonate rocks such as limestone creates solution channels by dissolving the rock along the surfaces of the fractures through which it flows. Over time, the solution channels can become quite large. Accordingly, these channels may hold and transmit enough water to supply public supply wells and industrial wells. Bedrock aquifers can be very complex because fractures decrease with depth and can "pinch-out" over short distances. However, faults in highly fractured bedrock may yield 200,000 to 400,000 gallons per day and have been developed for industrial use.



Bedrock Can Serve As An Aquifer if There are Enough Interconnected Fractures to Hold and Transmit Water

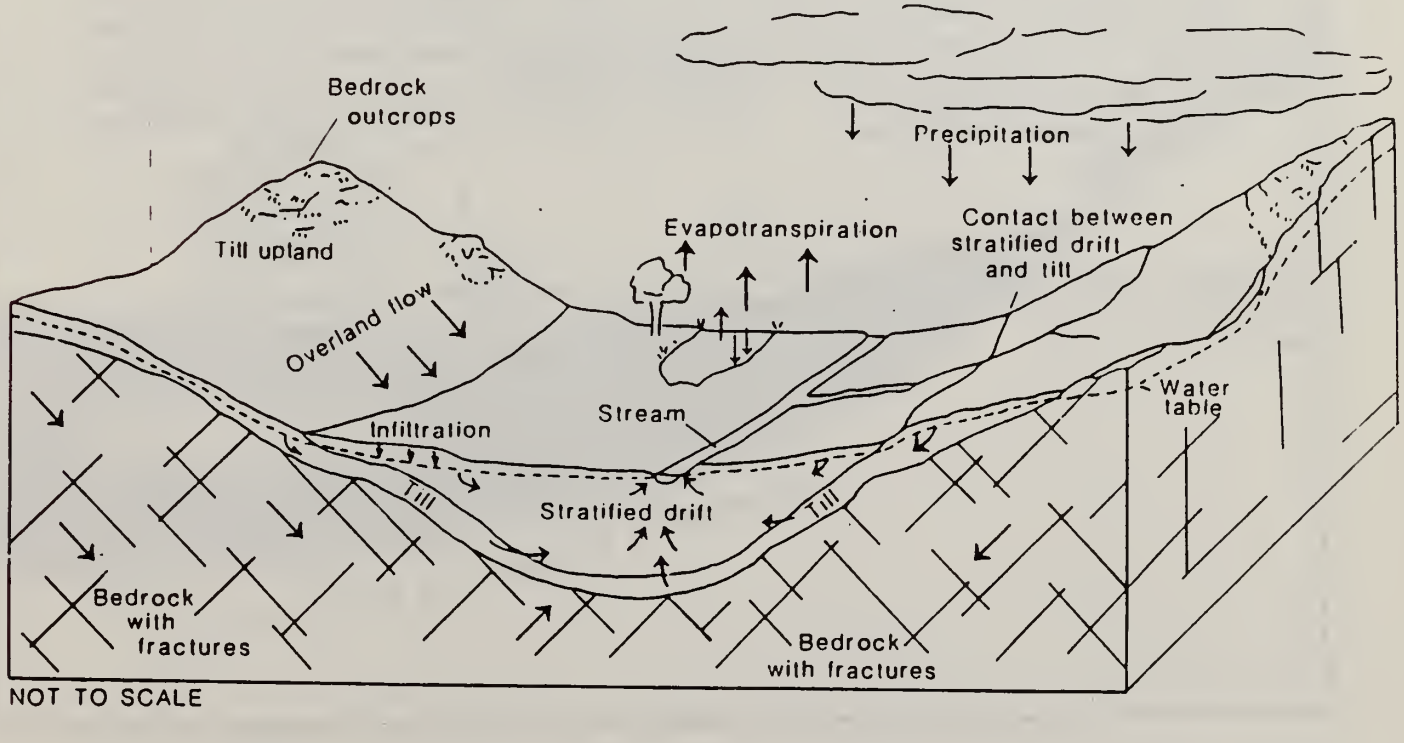


Solution Channels in Limestone-Small Areas in western Massachusetts Have Limestone Bedrock

SOURCE: Massachusetts Audubon Society, Groundwater Information Flyer 1, November/December 1983.

Goundwater Movement

Simply stated, groundwater moves from points of higher groundwater elevation (recharge areas) to points of lower groundwater elevation (discharge areas). Land surfaces that allow a significant amount of precipitation to infiltrate the soil and recharge the groundwater system are **recharge areas**. Streams, lakes, rivers, springs, wetlands and the ocean are **discharge areas**. Groundwater generally moves very slowly, in many places, less than 1 foot per day. In highly permeable aquifer materials such as well sorted sands and gravels, groundwater is capable of moving as much as 2 or 3 feet per day.



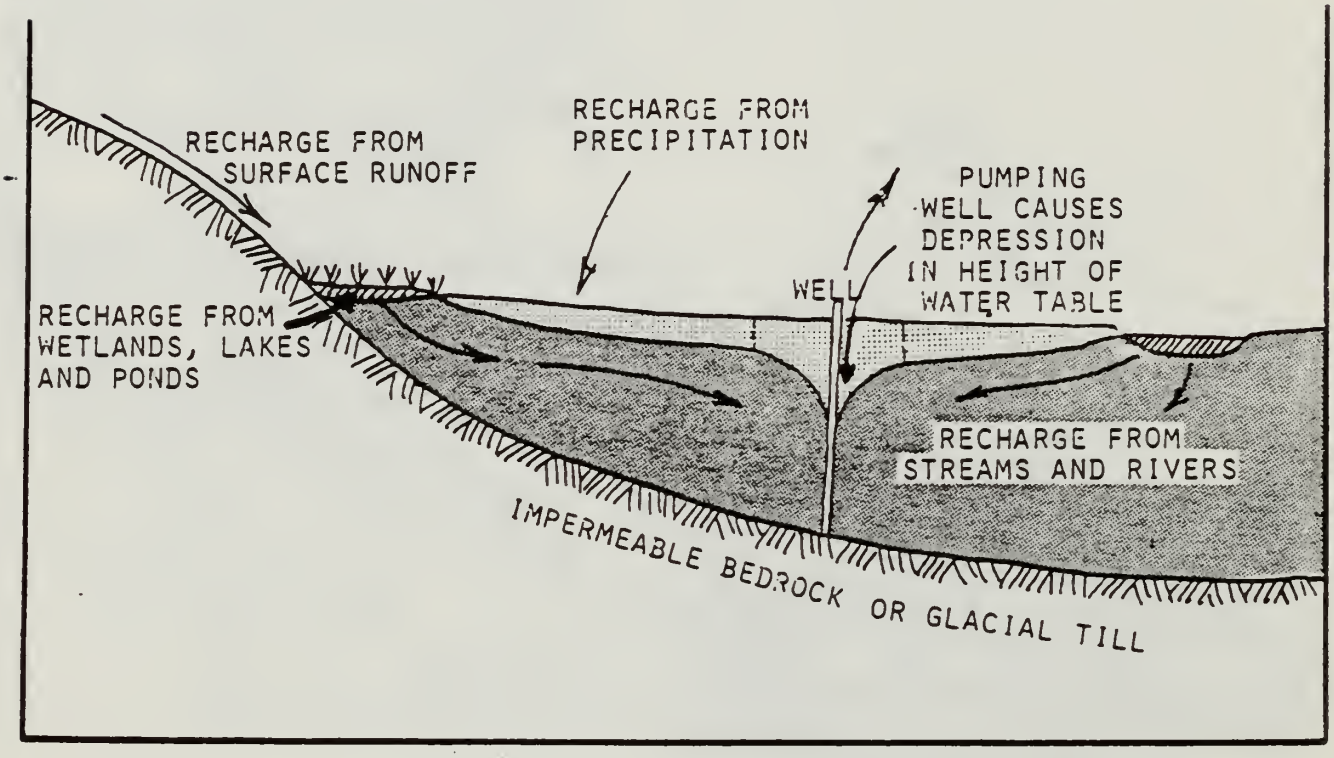
Recharge, Discharge and Generalized Groundwater Flow Patterns in a Stratified Drift Aquifer

SOURCE: U.S. Geological Survey, Open-File Report 86-543.

IV. Public Supply Wells

Cone of Depression

A pumping well creates an artificial discharge area by changing the direction of groundwater flow within the influence of the well. Instead of flowing towards its natural discharge area, groundwater is drawn into the well. The area around a pumping well is characterized by a cone of depression which outlines the area of drawdown or lowering of the water table elevation. The porosity and permeability of the aquifer materials, availability of recharge, the natural slope of the water table, the rate at which the well is pumped and the length of time the well is pumped all influence the size and shape of the cone of depression. When a well is pumped, nearby rivers or other surface water bodies such as streams or ponds may provide recharge to the well via a process known as induced infiltration.



A Pumping Well: Its Cone of Depression and Sources of Groundwater Recharge

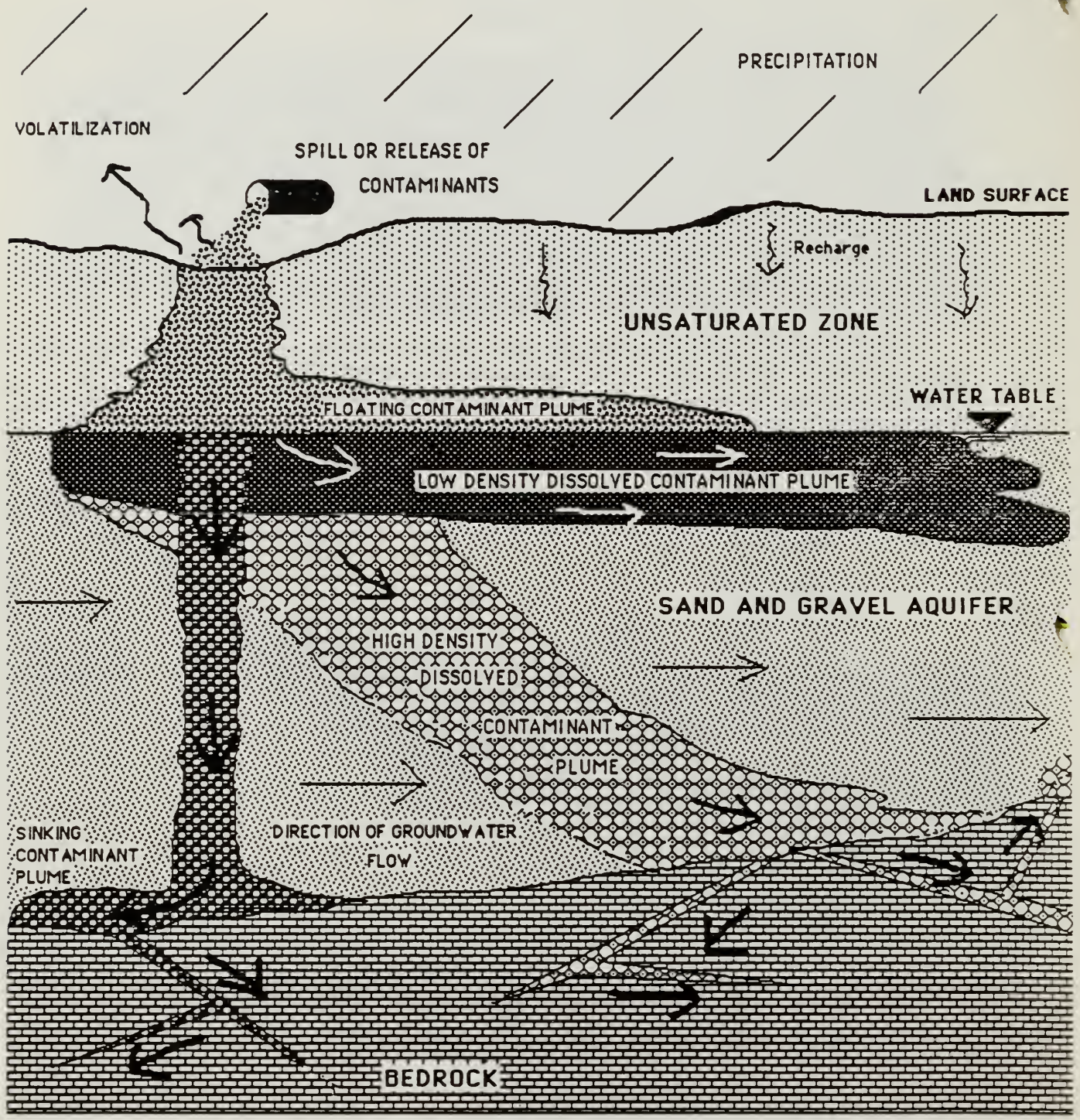
SOURCE: New York State Department of Environmental Conservation, February 1987.

Zone II Areas and Groundwater Contamination

The Guide to Contamination Sources for Wellhead Protection contains information on both the sources of groundwater contamination and the individual contaminants or classes of contaminants. Since the Zone II area supplies recharge to the public supply well under the most severe pumping and recharge conditions that can be realistically anticipated, local regulation of land use activities in this area is critical to maintaining potable water supplies. Contaminants that percolate down through the unsaturated zone to the aquifer have the potential to move with the groundwater flow and pollute the public supply well. Unlike the mixing and dilution that occurs between pollutants and the water in surface water bodies such as lakes and streams, pollutants in the groundwater remain concentrated in a **contaminant plume**.

The following section discusses the various properties of contaminants and the processes that occur in the unsaturated zone (the soil) and the aquifer that affect the behavior and fate of contaminants in the Zone II of a public supply well. The following figure, entitled "Factors Affecting Mobility and Attenuation of Contaminants", summarizes these processes in graphic form. It indicates that contaminants may move in various ways depending on several key factors including volatilization, dilution, chemical reaction, biodegradation, sorption and ion exchange.

Factors Affecting Mobility and Attenuation of Contaminants



Kimberly D. Noake
October, 1987

FIGURE NOT TO SCALE

FACTORS AFFECTING MOBILITY AND ATTENUATION OF CONTAMINANTS

Land Surface	Importance
Volatilization	high
Dilution	high
Chemical Reaction	high
Biodegradation	low
Sorption	low
Ion Exchange	low

Unsaturated Zone	Importance
Dilution/solubility	high
Chemical Reaction (oxidation/reduction)	high
Biodegradation	medium
Sorption	medium
Ion Exchange	medium
Volatilization	low

Aquifer	Importance
Chemical Reaction (oxidation/reduction)	medium
Sorption	medium
Ion Exchange	medium
Biodegradation	low
Dilution/solution	low
Volatilization	none

Bedrock	Importance
Chemical Reaction	medium
Sorption	low
Ion Exchange	low
Biodegradation	low
Dilution/solution	low
Volatilization	none

The description of the relative importance of factors affecting the mobility and attenuation of contaminants is general and relative to the varying properties of each contaminant including:

Volatility (loss to atmosphere)
Solubility (dissolution)
Viscosity (velocity)
Density (sink or float)
Ionic size and charge (sorption and ion exchange)
Biodegradability (chemical state)
Radioactive Decay Rate (radiation)
Chemical Reactivity (precipitation, solution and hydrolization)

The following pages contain discussion sections for each of the properties and processes listed above.

Properties Affecting Fate of Contaminants

V. DESCRIPTION OF PROPERTIES AND PROCESSESAFFECTING THE FATE OF CONTAMINANTS IN THE SOIL AND THE AQUIFER

Volatilization

The loss of a compound to the atmosphere is defined as volatilization. A compound is volatile if it readily evaporates when exposed to air.

Volatilization occurs on the land surface and in the unsaturated zone. Contaminants floating on top of the water table may volatilize. If the water table fluctuates, exposing the contaminant to air, volatilization may occur from the saturated to the unsaturated zone. Volatilization can attenuate toxic compounds that are resistant to biodegradation, relatively insoluble in water and weakly sorbed to soil particles. Compounds that are not soluble in water are less likely to be removed in leachate or runoff water and therefore, may be available for volatilization longer than water soluble compounds (EPA, Hazardous Waste Land Treatment, April 1983). Solvents, gasoline, light oils and phenols are volatile groundwater contaminants.

Volatilization of toxic compounds is not a benign occurence. When gasoline volatilizes in the unsaturated zone, the result is a toxic, flammable vapor that can seep into basements, houses and sewer lines.

Viscosity

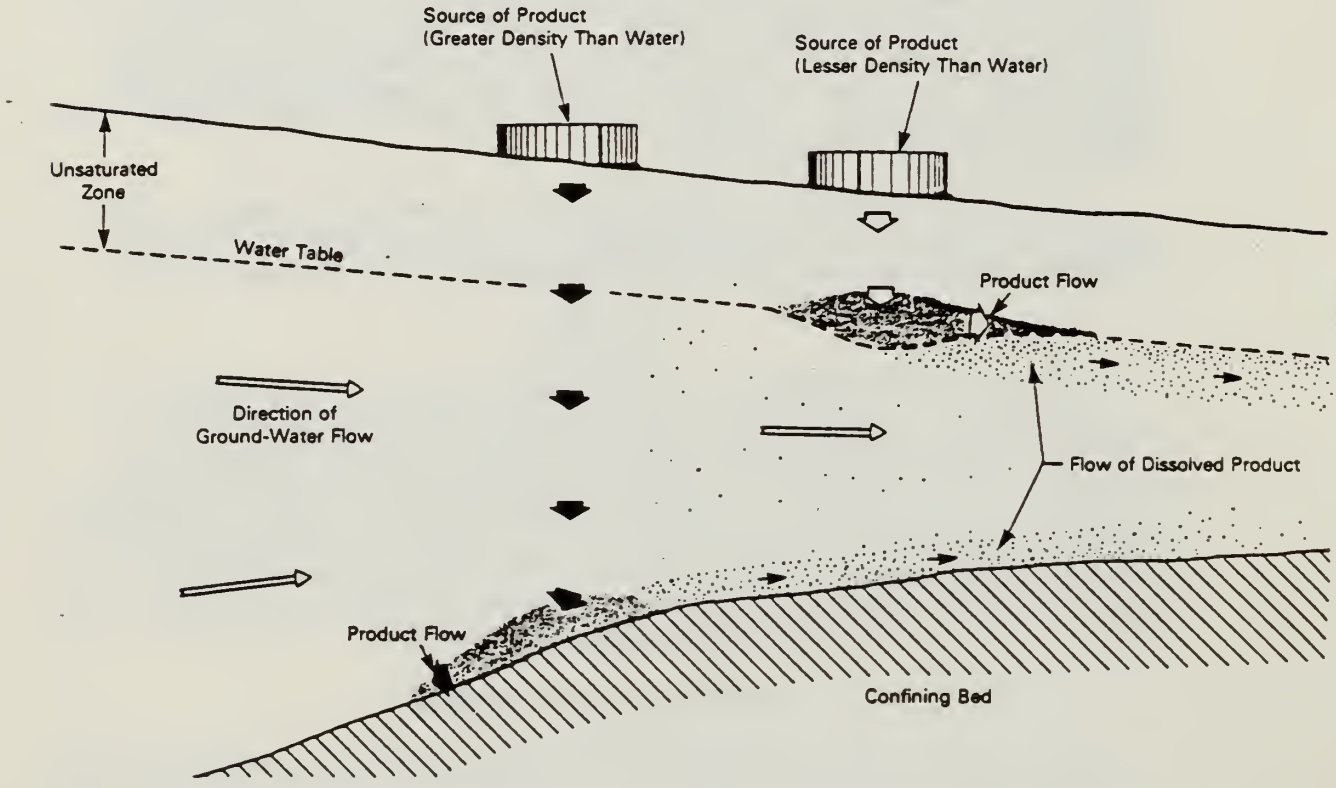
Viscosity is a property of a fluid and describes its resistance to relative motion during flow. The viscosity of a contaminant will partially control its rate of movement through the unsaturated zone. Highly viscous contaminants do not move easily through porous material. For example, #6 fuel oil, a highly viscous fluid, is a thick, gelatinous substance that does not pour or flow like #2 oil. A release of #6 oil tends to remain more or less immobile in the unsaturated zone due to its high viscosity. Gasoline, on the other hand, is less viscous than water and flows very easily through the unsaturated zone.

Density (Solution Density)

Density is a physical property of a substance and is defined as mass per unit volume (in other words - it defines how heavy the substance is). Solution density refers to the mass of a contaminant dissolved in a unit volume of groundwater. The solution density of a contaminant plume determines its movement through an aquifer. Contaminant plumes with a solution density greater than the groundwater tend to sink to the bottom of the aquifer and move slowly in relation to groundwater flow while contaminant plumes with a solution density less than groundwater tend to remain just below the water table or to rise as they move through an aquifer. Perchloroethylene (PCE) is an example of a "sinker." A contaminant that is less dense than the groundwater and not very soluble in water will float on the water table. Gasoline is an example of a "floater."

The figure below indicates these relationships. As it shows, "sinkers" can move along confining beds under the influence of gravity in a direction opposite to that of groundwater flow while soluble components of both "floaters" and "sinkers" can move in the direction of groundwater flow

In an idealized aquifer the saturated zone would consist of uniform, homogeneous materials and the contaminant would disperse and form an elliptical plume. However, most aquifers contain layered beds of heterogeneous material with varying permeability and lenses of relatively impermeable materials such as silt and clay. A contaminant plume moving through this aquifer will spread and branch around the irregular layers and lenses. Migration of the contaminant plume through an aquifer is a function of the contaminant's density, solution density and viscosity, the porosity and permeability of the aquifer, the reactive nature of the contaminant and the groundwater flow regime.



Effects of Density on Migration of Contaminants

SOURCE: Geraghty and Miller, 1985.

Solubility

The solubility of a substance is defined as the mass of a substance that will dissolve in a unit volume of a solute under specific conditions (Freeze and Cherry, 1979). A soluble contaminant is one that dissolves in groundwater. A contaminant dissolves when the attractive forces that hold the molecules together are less than or equal to the attractive forces of the water molecules. An insoluble contaminant is one whose molecules are held together by attractive forces stronger than the attractive force of water. For example, because gasoline is only slightly soluble in water and less dense than water it remains as a free floating contaminant on the water table (see section on Density). However, the gasoline additives benzene and methyl tertiary butyl ether (MTBE) are very soluble in groundwater and may move in a contaminant plume ahead of the gasoline plume.

Dispersion and Dilution

Precipitation that infiltrates the soil will dilute (reduce in concentration) contaminants in the unsaturated zone. Dilution also occurs in the aquifer as a result of dispersion.

The components of soil and aquifer materials are particles of sand, gravel and soil of various sizes and shapes arranged in many different orientations. Consequently, as water flows through the unsaturated zone and the aquifer, its velocity varies around particles and across pore spaces.

Dispersion is a mixing process whereby a contaminant will spread or disperse and gradually occupy an increasing volume of pore space in the materials of the unsaturated zone or in the aquifer. The result of the dispersion process is a contaminant plume. The configuration of the plume will vary depending upon the input source of the contaminant, type of aquifer materials and the groundwater flow regime. As the plume spreads out in the direction of groundwater flow, the concentration of the contaminant in the groundwater decreases.

Biodegradation

Biodegradation affects many organic groundwater contaminants including gasoline, oil and other hydrocarbons.

It is important to note that biodegradation processes can contribute toxic constituents to groundwater as well as remove them from the system. For example, the biodegradation of the toxic compound DDT can result in the more toxic intermediate product DDE.

Enzymes produced by microbes such as bacteria, fungi, yeasts and algae break down organic compounds through biodegradation. To manufacture these enzymes, microbes require nutrients such as carbon, phosphorous and nitrogen as well as oxygen and water. They will grow under a wide range of pH's, temperatures, and nutrient conditions and are capable of attacking many complex organic compounds.

Biodegradation of contaminants by anaerobic bacteria occurs in the absence of dissolved oxygen (groundwater), while aerobic bacteria require the presence of free oxygen (soil).

In the presence of gasoline or oil in the unsaturated zone (soil), certain species of aerobic and anaerobic bacteria grow rapidly and may, if nutrient conditions are favorable, consume much of the oil or gasoline that accumulates above the water table (Freeze and Cherry, 1979).

Laboratory studies of soils, sediments and waters have indicated the biodegradation of a variety of organic compounds including pesticides, aromatic hydrocarbons and refractory (resistent to degradation) compounds such as chlorinated pesticides and some halogenated hydrocarbons (Cherry et al., 1984).

Hydrolysis

Hydrolysis is a process in which the hydronium ions (H_3O^+) and hydroxyl groups (OH^-) in groundwater influence the breakdown of substances. In groundwater, the hydrolysis of relatively insoluble minerals results in new minerals being formed and ions being released into solution. Hydrolysis is also an important reaction in the weathering of rocks which produces soils and clays.

Complex organic compounds may be broken down by hydrolysis into simpler compounds which may then be attenuated through other processes (EPA, May 1985). Also, these simple compounds (daughter products) may be less harmful constituents of the groundwater. When an organic compound undergoes hydrolysis, a chemical group (X) is replaced by a hydroxyl group (OH^-). For example, the hydrolysis of a halogenated hydrocarbon involves the introduction of a hydroxyl group and the loss of halogens (X). The hydrolysis of pesticides is an important attenuation mechanism. It may be used to predict the rate of decay of pesticides in soil (Cherry et al., 1984).

Ion Exchange

Ion exchange is an important process for the attenuation of heavy metals. Soils and aquifer materials with a high percentage of colloidal particles have a greater ability to attenuate heavy metal contaminants onto the particle surfaces. However, if the ionic bonding is not strong enough to prevent the reversal of the chemical reaction, the contaminant will be released into the groundwater system.

Ion exchange and sorption are similar processes, however, stronger ionic bonding occurs on particle surfaces in the ion exchange reaction. Like the sorption process, ion exchange occurs on colloidal particles (diameter 10^{-3} to 10^{-6} millimeters) such as clay minerals and hydrated oxides of iron and manganese because they have large electrical charges relative to their surface areas. Humus, plant roots and other organic materials also have a high ion exchange capacity. The ion exchange occurs on particle surfaces with a charge imbalance. The positive or negative charge of a particle must be balanced with the accumulation of a layer of ions of the opposite charge. This layer of ions can change in composition; thus the process is reversible.

Examples of Types of Ion Exchange

CLAY MINERALS -
form ionic bonds with:

- Heavy metals

  Copper
  Lead
  Mercury
  Zinc

- Radioactive elements

  Cesium
  Rubidium
  Strontium

Hydrated OXIDES OF IRON -
form ionic bonds with:

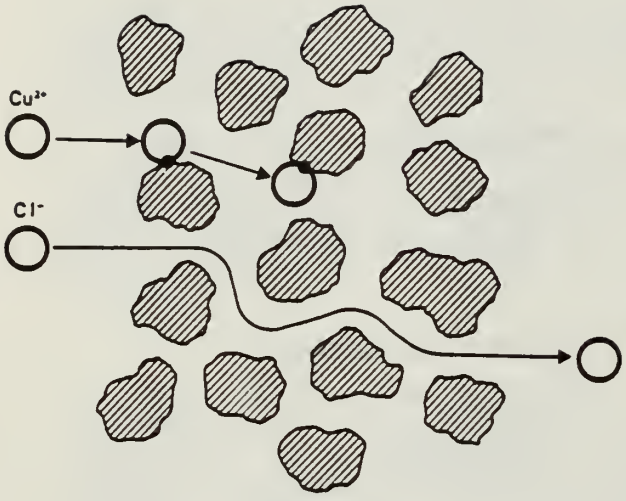
- Heavy metals

  Chromium
  Copper
  Lead
  Mercury
  Molybdenum
  Tungsten
  Vanadium
  Zinc

Hydrated OXIDES OF MANGANESE -
form ionic bonds with:

- Heavy metals

  Cobalt
  Chromium
  Molybdenum
  Nickel
  Tungsten





Ion Exchange

Metal Ion Movement Slowed by Ion Exchange

SOURCE: Geraghty and Miller, 1985.

Sorption

Sorption describes the combination of two processes - absorption and adsorption. Absorption refers to the physical capture of a molecule or ion, and adsorption is a chemical bonding of a molecule or ion on to a charged particle.

Sorption occurs on particles that have free bonding surfaces, i.e., colloidal particles (diameter 10^{-3} to 10^{-6} millimeters). They have a large charge relative to their surface area. Constituents of soils and aquifer materials commonly present in colloidal form include clay minerals, organic substances (especially humus), hydrous iron, manganese and the rock forming minerals feldspar, mica and hornblende. Consequently, soils and aquifers that contain a high percentage of colloidal particles have a greater ability to sorb contaminants onto the particle surfaces.

Sorption is important in the attenuation of relatively insoluble, nonpolar (not attracted to water) organic substances such as the aromatic and chlorinated hydrocarbons (please see section on Solvents).

Description of Contaminants

VI. DESCRIPTION OF CONTAMINANTS

Acids and Bases

By definition, acids are substances that produce hydronium ions (H_3O^+) when dissolved in water and bases are substances that produce (OH^-) hydroxyl groups when dissolved in water. Acids are corrosive and have a low pH while bases (also known as alkalies) are characterized by a high pH. Laundry bleach, ammonia and lye are three common bases; vinegar and hydrochloric acid are examples of two common acids. Industrial wastes, wastewater streams from jewelry and metal plating shops, machine shops, furniture stripping businesses, research labs and hospitals and leachate from landfills, junkyards and industrial pits/lagoons contain acids and bases such as hydrochloric acid, sulfuric acid, sodium hydroxide and ammonia. Although a pure acid or base solution can be effectively neutralized, thereby reducing the threat to water quality, highly acidic or basic wastes from these businesses usually contain other toxic constituents such as heavy metals and solvents (please refer to appropriate sections for additional information).

High concentrations of acids in water will mobilize metals in the soil and groundwater. The hydronium ions (H_3O^+) produced by acids have a positive charge and compete with positively charged trace metals like lead (Pb^{4+}) and zinc (Zn^{2+}) for exchange sites on organic and colloidal-sized particles in the soil. The hydronium ions are sorbed onto these particles instead of the metal ions. Consequently, the metals remain in solution and can move through the soils into the groundwater. A highly acidic or basic plume moving through the soil will drastically change the pH of the soil system, disrupt other chemical equilibriums and may result in the reversal of attenuation processes and the mobilization of contaminants. A discharge of wastewater containing high concentrations of an acid or a base solution into a septic system will kill the bacteria that decompose the waste and reduce the effectiveness of the septic system. In some instances, it may result in the failure of the entire system. As acidic drinking water flows through municipal distribution systems and residential or commercial plumbing, its corrosive action dissolves the metal piping, releasing lead, copper and asbestos fibers into the water. This is a major water treatment problem.

Key Examples of Acids and Bases

Acids		Bases	
Chloric acid	$HClO_3$	Ammonia	NH_3
Nitric acid	HNO_3	Calcium Hydroxide	$Ca(OH_2)$
Nitrous acid	HNO_2	Potassium Hydroxide	KOH
Sulfuric acid	H_2SO_4	Sodium Hydroxide	NaOH
Hydrochloric acid	HCl		

Behavior/Fate of Acids and Bases

- Highly soluble in water
- Not persistent in soil and water; generally neutralized or diluted
- Metals tend to be soluble in acids and insoluble in bases

Chloride

The dissolution of halite and other chloride-bearing rocks contributes natural (background) concentrations of chloride to groundwater. Chloride is a common by-product of the chlorinated hydrocarbon wastes generated by some industries. Another source of chloride ions is the road salt used to deice roads and parking lots. Road salt enters the groundwater as runoff from roads and uncovered salt piles. In some cases of groundwater contamination by road salt, chloride is listed as the primary contaminant. Septic systems and water softening units also contribute chloride to groundwater.

Chloride is considered to be a secondary contaminant. Drinking water that contains excess chloride concentrations is considered to be aesthetically displeasing. The Federal Secondary Drinking Water Standards established the maximum contaminant level as 250 mg/l. Water with a chloride concentration above this level has a salty taste. However, in some cases, the presence of excessive chloride concentrations may be linked with the presence of sodium which can have adverse health effects for some portions of the population (see section on Sodium).

Key Examples

Sodium Chloride (NaCl) is used as a deicer for roads and parking lots

Behavior/Fate of Chloride

- very soluble
- highly mobile

Fluoride

Fluoride is a natural (background) constituent of soils. Wastes generated from the production of phosphate fertilizers, hydrogen fluoride (used in the etching of glass) and fluorinated hydrocarbons contain fluoride. Aluminium and steel industries as well as kilns (manufacture bricks) generate wastes that contain fluoride. As an additive to drinking water, toothpaste and other dentifrices, fluoride helps to prevent dental caries (cavities).

The overall threat to public health from excess fluoride in drinking water is relatively low. However, the ingestion of excess fluoride causes fluorosis, a disease which results in brittle and sensitive teeth and bones. Excess fluoride can also mottle or discolor teeth.

Uses

- ingredient in toothpaste and other dentifrices
- additive to drinking water

Behavior/Fate of Fluoride

The solubility and mobility of fluoride are related to the type and quantity of available cations (Na^+, Ca^+) in the soil that form salts with the fluoride ion (F^-).

- o Sodium salts of fluoride (NaF) are quite soluble and mobile
- o Calcium salts of fluoride (CaF) are relatively insoluble; therefore, limited amounts of fluoride are taken up by plants or leached through the soil

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Heavy Metals

Heavy metals are not commonly found as natural constituents of groundwater. Generally, in order for the metals to be soluble and mobile in groundwater, the water must be acidic (low pH) and flowing in a reducing environment, i.e., in contact with organic material or concentrated leachate from a waste disposal site. If the pH of the water becomes more alkaline (high pH) and is flowing in an oxidizing environment, the metals become insoluble and will precipitate out of solution as a solid phase.

Federal Drinking Water Standards (Maximum Contaminant Levels) have been established for the following metals:

Metal	EPA Standard (mg/l)	Toxicity	Uses
Cadmium (Cd)	0.01	Causes high blood pressure and kidney damage; destroys testicular tissue and red blood cells; toxic to aquatic biota	Cadmium-nickel battery production; pigments for plastics, enamels and paints; fumicides; electroplating and metal coating
Chromium (Cr)	0.05	Essential trace element; possibly carcinogenic	Corrosion inhibitor; topical antiseptics and astringents; tanning and dye industry
Copper (Cu)	1.00	Essential trace element; not very toxic to animals; toxic to plants and algae at moderate levels	Industrial wastes from textile mills; cosmetics manufacture; hardboard production
Lead (Pb)	0.05	Toxic - causes anemia, kidney disease, nervous disorders; wildlife destruction	Lead-acid storage batteries; gasoline additives; pigments; paints; herbicides; insecticides
Mercury (Hg)	0.002	Acute and chronic toxicity	Wastes from electrical apparatus manufacture; production of chlorine and caustic soda; pharmaceuticals; paints; plastics; paper products; pesticides
Silver (Ag)	0.05	Causes blue-grey discoloration of the eyes, skin and mucus membranes	Wastes from photographic, mirror, and electroplating manufacturing
Zinc (Zn)	5.0	Essential element; aids wound healing; toxic to plants at higher levels	Brass and alloy production; galvanized metals for pipes, utensils; insecticides; glues; rubber; inks and glass; major component of sewage sludge

Behavior/Fate of Metals

Predicting the transport and migration of metals is difficult due to the complex hydrochemical environment of the groundwater system. However, in general, the process of ion exchange causes the metals to migrate very slowly relative to groundwater flow velocities. In the presence of colloidal-sized clay particles, organic matter and iron and manganese hydroxides in the soils and the aquifer, metals become bonded to the particle surfaces and immobilized. Therefore, localized contamination by metals is common (EPA, May 1985).

Iron and Manganese

Iron, one of the most abundant elements in the earth's crust, is a natural constituent of aquifer materials. Groundwater with high iron concentrations is common in naturally occurring acidic or reducing conditions and in aquifers located over crystalline bedrock. Industrial wastes and drainage water from mines contain various concentrations of iron.

Manganese is a common constituent of salts and minerals. It is present in the waste products of the iron and steel industries and is used in the manufacture of paints, disinfectants and fertilizers.

Iron and manganese are considered "secondary contaminants". The Federal Secondary Drinking Water Standards list the maximum contaminant level for iron and manganese as 0.3 mg/l and 0.05 mg/l respectively. Excess iron and manganese concentrations in drinking water are rarely a threat to public health; rather, they reduce the aesthetic qualities of the water. Water with iron concentrations above 0.3 mg/l develops a brown color which stains laundry and porcelain fixtures. The water will also have a particularly undesirable astringent taste. Manganese levels above 0.05 mg/l result in similar aesthetic problems. Iron and manganese particles also collect in water distribution systems and clog pipes, joints and valves.

	Uses
Iron	Alloys, magnets, machinery
Manganese	Alloys, the manufacture of paints, disinfectants, lime and micronutrient fertilizers, dry cell batteries, chemical reagents

Behavior/Fate of Iron and Manganese

In the anaerobic environment of an aquifer, iron and manganese are in solution. As water is extracted from the aquifer, it passes into an aerobic environment and the metals precipitate as particulate matter and the water becomes discolored.

Under reducing conditions (i.e., groundwater), the usually soluble and mobile Mn^{+2} (manganese) ion will be strongly sorbed to clay, minerals and organic matter. As pH rises, Mn^{+2} becomes less soluble. Several stable manganese compounds will form under oxidizing condition. They give the water a brown color and change its taste.

Iron, in its reduced form, is soluble and remains in solution. With very small changes in soil conditions or bacterial activity, iron will come out of solution in its particulate oxide form. Iron oxides are relatively insoluble and, like the manganese compounds, will add a brown color to water and change its taste.

Nitrates

The presence of dissolved nitrogen in the form of nitrate (NO_3^-) in groundwater is commonly the result of: (1) leachate from septic systems, (2) runoff from lawns and roads, (3) leachate from septage lagoons, (4) discharges of municipal and industrial sanitary wastewaters, (5) runoff from animal feedlots and crop lands and (6) leachate from landfills. Nitrates can enter the groundwater directly as nitrates contained in fertilizers and wastes applied to the land surface, or they can be generated through a series of biological reactions that occur as part of the nitrogen cycle - nitrogen is transformed into nitrate (NO_3^-), nitrite (NO_2^-), ammonia (NH_3), ammonium (NH_4^+), nitrogen gas (N_2) and nitrous oxide (N_2O).

In the anaerobic environment of the septic tank, organic nitrogen contained in influent wastewater is converted to ammonium ions (NH_4^+) which are then discharged with the effluent from the leaching field into the soil. As the NH_4^+ encounters the oxygen in the aerobic environment of the soil, bacteria convert it to nitrite (NO_2^-) and then to nitrate (NO_3^-) through a process known as nitrification. Another source of ammonium ions for the nitrification process is ammonia in its gaseous state. Ammonia (NH_3) is highly soluble in water and some of the dissolved ammonia will react with the water to form ammonium ions (NH_4^+). The process of nitrification occurs under aerobic conditions in the oxygen-rich soil zone above the water table. Under anaerobic conditions, in saturated soils and the aquifer, bacteria convert nitrate to nitrogen gas (N_2) or nitrous oxide (N_2O) through a process known as denitrification.

At concentrations in excess of the Maximum Contaminant Level of 10 mg/l, nitrates in drinking water can be a health hazard. When drinking water contaminated by nitrates is ingested and enters the gastrointestinal tract, the nitrates convert to nitrite and enter the bloodstream. In the blood, nitrites react with hemoglobin to produce methemoglobin which impairs the blood's ability to transport oxygen.

Infants under three months of age and fetuses are particularly susceptible to this reaction and develop a condition known as methemoglobinemia or "blue baby disease" which can be fatal. The USEPA has determined that drinking water with nitrate concentrations below 10 mg/l is safe for infant consumption. The presence of nitrate-nitrogen in concentrations that exceed the drinking water standards frequently indicates the presence of other contaminants in the groundwater. Massachusetts has adopted 10 mg/l as the Maximum Contaminant Level for nitrate-nitrogen in drinking water supplies.

Behavior/Fate of Nitrates

- Due to their negative charge, nitrate ions (NO_3^-) are not attracted to negatively charged soil particles.
- Nitrates are highly soluble in groundwater; when dissolved in groundwater they move with the groundwater with minimal transformation or retardation.
- In aquifer materials that contain dissolved oxygen, the ammonia form of nitrogen can convert to nitrate-nitrogen.
- **The only form of attenuation affecting nitrate-nitrogen is dilution.**

Pathogens/Viruses

The presence of Escherichia coli (E. coli), a species of coliform bacteria, in groundwater indicates contamination by human and animal wastes. Since all human and animal waste contain coliform bacteria, their presence in groundwater signals the possible presence of viruses and pathogenic bacteria. In most cases, the microorganisms contaminating groundwater are the bacteria and viruses found in the gastrointestinal tract. Consequently, the types of illnesses contracted from ingestion of this contaminated groundwater are generally gastrointestinal diseases.

Groundwater contaminated with pathogenic bacteria and viruses is commonly the result of failing septic tanks or cesspools, runoff from animal feedlots that contains fecal matter and land application of animal wastes (e.g. manure spreading). The Environmental Protection Agency's (EPA) Maximum Contaminant Level (MCL) for coliform bacteria requires routine testing of a specified number of samples. Ninety to ninety-five percent (90-95%) of all samples must be free of coliform. This percentage is dependent on the number of the samples and type of analysis. According to the EPA, the frequency of groundwater contamination due to viruses and parasites is relatively low. However, these low incident figures may be

misleading. Detection methods for viruses and parasites are analytically limited. The effect of these pathogens on groundwater quality should not be underestimated.

Pathogenic Biological Organisms

Organism	Associated Effect
Bacteria	Typhoid Bacillary dysentery Cholera Gastroenteritis Tuberculosis
Viruses	Enteroviruses Hepatitis
Parasites	Protozoa Worms Fungi

Behavior/Fate

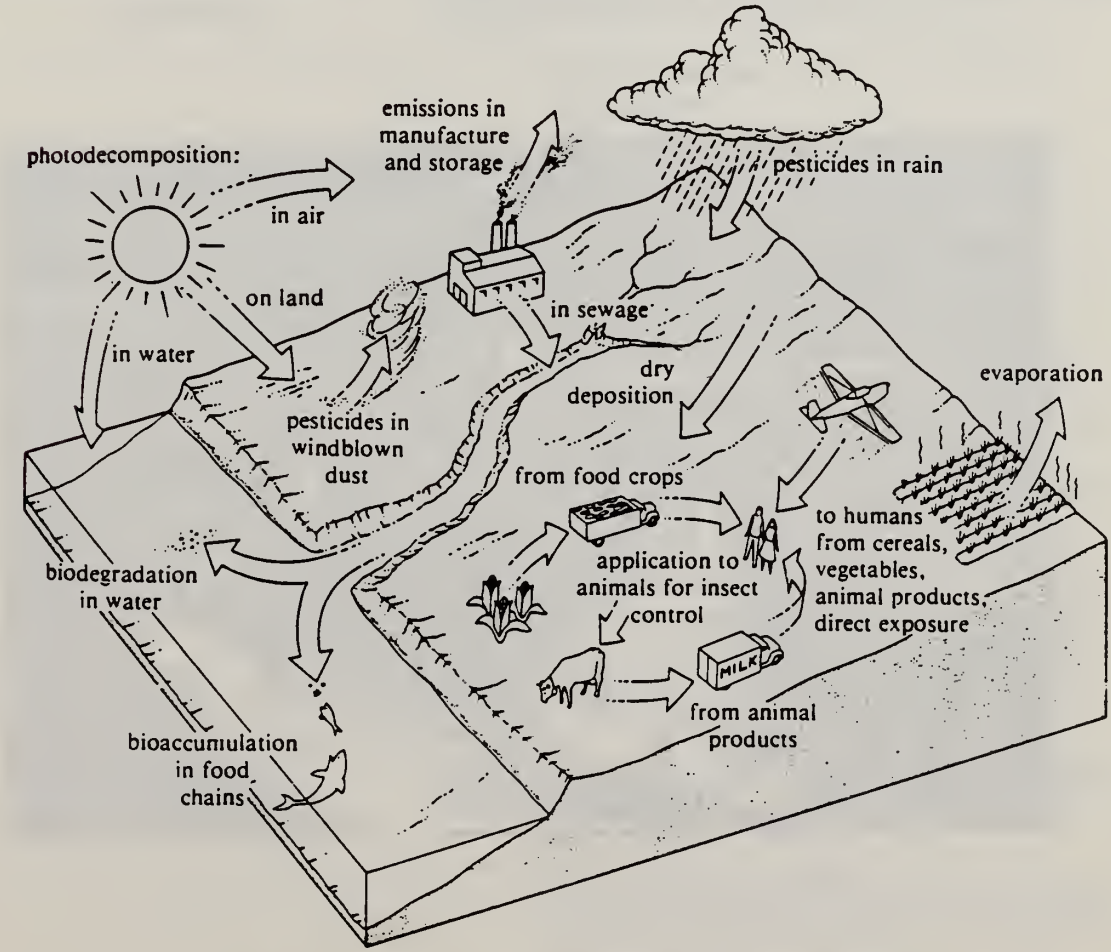
- bacteria subject to biological activity, filtered on soil particles; not very persistent
- Fate of bacteria determined by:
  - moisture content, temperature and pH of soil
  - longevity of species

Pesticides

The term "pesticides" refers to a wide range of chemicals including herbicides, rodenticides, insecticides and fungicides. Manufacture, application, storage and disposal of pesticides are processes that can threaten groundwater quality.

Pesticides are available in liquid, gas, granular or dust form. Aircraft, foggers, ground spray rigs, irrigation systems, soil injectors, and spreaders are used by farmers, government agencies, utility companies and others to apply pesticides.

Farmers use pesticides to kill or damage pests and weeds and to control diseases that threaten crops. Pesticides are used by government agencies to control mosquito and gypsy moth populations. Railroad companies and public utilities rely on pesticides to defoliate tracks, embankments and rights-of-way. The application of pesticides is common



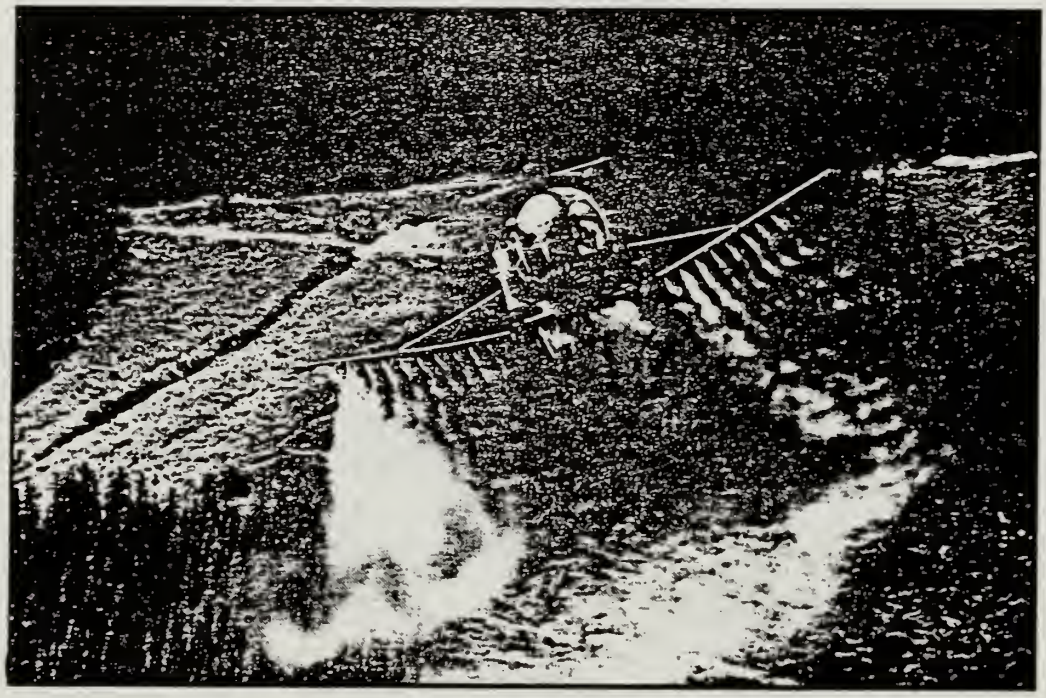
Major Aspects of Pesticides in the Environment

SOURCE: Manahan, Stanley E., Environmental Chemistry, PWS Publishers, Boston, MA 1984.

during the routine maintenance of athletic fields, schoolyards, parks and golf courses. Lawn-care companies frequently store and mix pesticides for application to residential lawns and the grounds surrounding institutions and businesses. Homeowners use a variety of pesticides for lawn and garden maintenance and indoor pest control.

Pesticides can contaminate groundwater by percolation through the soil or man-made conduits such as drainage wells and ditches, infiltration basins and wells. Precipitation dissolves pesticide residue on plants and trees producing contaminated water which may infiltrate the soil cover or flow as surface runoff. Agricultural runoff and erosion due to irrigation or precipitation produce contaminated water and soil laden with pesticides.

Pesticides move from the soil to the ground water system by the process of leaching. Several site-specific factors affect the leaching of pesticides including the soil type and topography of the area, the water table elevation, the amount of rainfall or irrigation the area receives and the method of pesticide application. Solubility, volatility and the capacity to bind to soil particles or degrade are properties of pesticides that affect their leaching through the soil.



Pesticide Applications of all Types are a Source of Groundwater Contamination

SOURCE: U.S. Environmental Protection Agency, May 1987.

EXAMPLES OF SOME PESTICIDES WITH POTENTIAL TO AFFECT GROUNDWATER

Pesticide	Uses and Some Properties
Alachlor	Herbicide for use on broadleaf grasses, weeds and crops such as corn and soybeans - can leach through soil - microbial degradation occurs in soil - persists (average) 6-10 weeks - once it reaches water, it is persistent
Aldicarb	Insecticide used to control Colorado potato beetle and golden nematode - applied directly to soil, like fertilizer - can leach in fine to coarse textured soil with high organic content - low solubility in water
Oxamyl	Insecticide used to control nematodes on potato crops - persistence is dependent on pH; broken down in basic water, stable in acidic water - degradation influenced by sunlight, aeration, high temperatures - breakdown products are less toxic than parent products - not very persistent in soil; 6-8 days required for one-half of the Oxamyl to break down
Dinoseb	Herbicide used to control weeds on various agricultural field crops (potatoes) - persistent in water - can be degraded in the soil; takes 34-111 days for one-half of the Dinoseb to break down

BEHAVIOR/FATE OF PESTICIDES

Pesticides	Characteristics
Chlorinated Hydrocarbons	
Alachlor Chlordane Dinoseb Ethylene Dibromide (known as EDB) Lindane	- resistant to degradation; very persistent - highly volatile - breakdown products may be more toxic and/or more persistent than parent compound - very susceptible to leaching
Carbamates	
Aldicarb (Temik) Carbofuran Oxamyl	- more susceptible to degradation; less persistent - breakdown products less toxic than parent compound
Organophosphates	
Malathion Parathion	- tend to hydrolyze quickly at or above a neutral pH

Alachlor, Dinoseb, EDB, Carbofuran, Aldicarb, Oxamyl, 1,2-D and 1,3-D have been found in Massachusetts groundwater.

Petroleum Products

Gasoline, diesel fuel, kerosene, heating oil, motor oil, and grease are petroleum products commonly used for industrial, commercial and domestic purposes. State and municipal transportation facilities, service stations, truck stops, gas stations and airports use petroleum products in routine maintenance and service operations. Machine shops, metal-working shops and other small industries rely on petroleum products as lubricants and rust inhibitors. Do-it-yourself mechanics use petroleum products in the repair and maintenance of automobiles, farm machinery and other equipment.

Typically, heating oil, waste oil, gasoline, diesel fuel and kerosene are stored in underground storage tanks. New motor oil, grease and other lubricants are usually stored in drums.

In most cases, the presence of petroleum products in groundwater can be attributed to leaking underground storage tanks and piping systems (see section on Underground Storage Tanks) and other inadequate storage

facilities, accidental spills/leaks and improper disposal of waste products. Improper disposal practices include land dumping of drums and other containers and disposal of waste products into domestic septic systems, storm drains or floor drains. Substandard storage areas for drums and aboveground tanks often lack coverings and/or impervious pads as well as equipment to handle accidental spills and leaks.

Key Examples

Components of petroleum products commonly associated with groundwater contamination -

Gasoline Components

- Benzene
- Toluene
- Xylene

Benzene, Toluene and Xylene are sometimes referred to as BTX

Gasoline Additives

- Methyl tertiary butyl ether (MTBE)
- Methanol
- Ethanol

MTBE is a common gasoline additive in New England gasoline while methanol and ethanol are currently rare additives to New England gasoline

- Ethylene Dibromide (EDB) is an additive to leaded gasoline

Oil Components

- Sulphur
- Cadmium and other heavy metals

Behavior/Fate of Petroleum Products

Behavior/Fate of Gasoline/Light Oils

- very volatile (surface spills quickly evaporate)
- low density (float on the water table)
- low solubility
- persistent in soil and groundwater

  As petroleum products move through the zone of aeration they tend to leave a residue in the pore spaces between rock and soil particles. When rain and melting snow percolate through the soil, the soluble components of the petroleum residue are flushed out and may enter the groundwater.
- product will degrade with the additions of nutrients and oxygen

Behavior/Fate of Gasoline Additives

- very soluble
- very mobile
- may move in a plume ahead of the gasoline plume

Behavior/Fate of Heavy Oils (waste oil, #6 fuel oil)

- high viscosity (thick)
- low solubility
- less volatile than gasoline/light oils
- less mobile than gasoline/light oils
- more persistent in soil than gasoline/light oils

Phenols

Phenols, also known as carbolic acids, are widely used as disinfectants and are found in industrial wastes, coal and petroleum processing wastes and waste streams from research laboratories, hospitals and universities. Creosols, another group of phenols, have even greater germicidal properties and are commonly found in spray disinfectants used in hospitals or at home. Creosote, widely used as a wood preservative for building lumber, boat docks and fences, contains cresols. Many industries use phenols in the production of pharmaceuticals, germicidal paints, plastics and disinfectants. Hospitals and research laboratories use phenols as reagents and indicators. Resins, dyestuffs, solvents and additives for gasoline and lubricants contain phenols.

Key Examples

Phenols	Resins, solvent, pharmaceuticals, dyestuffs and indicators, reagents, germicidal paints, disinfectant
Creosote	Wood preservative
2,4-Dimethyl phenol	Pharmaceuticals, plastics, disinfectants, solvent, insecticides, fungicides, dyestuffs, additive to gasoline and lubricants.

Radioactivity

A radionuclide, such as uranium or radium, is a radioactive element that spontaneously emits ionizing radiation in the form of alpha particles, beta particles, and gamma rays. These radioactive emissions knock electrons off atoms and molecules, forming ions. In living plants and animals, the effects of ionizing radiation are chemical changes in cells, harmful chemical reactions in tissues and genetic damage.

A single radionuclide (the parent element), will produce a collection of radionuclides by successive emissions of alpha or beta particles until some nonradioactive atom is formed. This process is radioactive decay. For example, uranium-238 is the parent element for a naturally occurring radioactive series that consists of 18 members. The rate of decay is described as the half-life of the element: the period of time it takes for

one-half of the atoms in a radionuclide to decay. Radionuclides with a long half-life are persistent in the environment while radionuclides with a short half-life rapidly decay.

Sources of Radionuclides

Radioactive species occur naturally in practically all materials and constantly emit a stream of subatomic particles and radiation. Radium and potassium-40 are radionuclides that originate from natural resources, i.e., the leaching of minerals and uranium ore. High-energy particles from outer space bombard the earth's upper atmosphere resulting in cosmic radiation that travels down to the earth's surface. Natural radioactive substances and cosmic radiation are known as background radiation. Other sources of radiation include medical and dental x-rays and other medical uses.

Waste products of nuclear power generation and the manufacture of nuclear weapons contain large quantities of radionuclides. Industries, research labs and hospitals use artificially produced radionuclides as "tracers". These may be improperly disposed of by being flushed down a drain, entering groundwater through an on-site waste disposal system or wastewater treatment plant discharge point.

Radionuclides in Water

Radionuclide	Half-life
Naturally Occurring	
Carbon-14	5730 years
Silicon-32	~300 years
Potassium-40	~1.4 x 10^9 years
Naturally Occurring from ^{238}U series	
Radium-226	1620 years
Lead-210	21 years
Thorium-230	75200 years
Thorium-234	24 days
From Reactor & Weapons Fission	
Strontium-90	28 years
Iodine-131	8 days
Cesium-137	30 years

SOURCE: Adapted from Manahan, Stanley E., Environmental Chemistry, PWS Publishers, Boston, MA 1984.

Sodium

Sodium ions are a natural (background) constituent of groundwater. In Massachusetts, background concentrations in fresh water range from 0.5 mg/l to 15 mg/l.

To maintain the body's sodium balance, the recommended daily intake of sodium for a normal adult is between 1,100 and 3,500 milligrams per day. However, some individuals with cardiovascular disease, metabolic disorders, kidney or liver problems must limit their sodium intake to as little as 500 mg/day. Excessive sodium intake has been correlated with high blood pressure, the development of hypertension and Sudden Infant Death Syndrome (crib death).

The Massachusetts standard for sodium in drinking water, 20 mg/l, protects those individuals who may be at risk if they exceed the limits of their low sodium diets. When sodium levels in public drinking water supplies exceed the state standard, the state and all users of the water are notified.

High sodium concentrations in groundwater commonly result from the use and storage of sodium chloride (road salt). Sodium chloride is soluble in water and enters the groundwater as runoff from uncovered road salt stockpiles and paved surfaces. Other sources of sodium ions include salts in septic system leachate, home water softening units and chemicals containing sodium (e.g. sodium hydroxide) frequently added to municipal water supplies to adjust pH levels, prevent corrosion and treat for lead.

Key Examples

	Uses
Sodium chloride	deicer for roads and parking lots
Sodium hydroxide	corrosion control in older water distribution systems

Behavior/Fate

- very soluble
- highly mobile
- not persistent in soil

Solvents

Solvents are present in industrial, commercial and domestic degreasers and cleaners. Typically, solvents are used to clean parts in automobile repair shops, metal-working and electronic industries and other small industries. Almost any land use involving machinery will use some amount

of solvent as a degreaser. Dry cleaning and furniture stripping businesses rely on solvents for cleaning agents. Solvents are also used in routine laboratory analyses conducted by hospitals, schools and laboratories. Many common domestic products used in households contain solvents including nail polish remover, drain openers, detergents, cleaners, paint thinners or varnish thinners/removers, and septic system cleaners. Volatile organic compounds (VOCs), which include solvents, are the most common contaminants responsible for the closing of public supply wells in Massachusetts.



SOURCE: Hughes, Henry B.F., et al, Center for Environmental Research, Water Resources Program, Cornell University, January 1985.

The presence of solvents in groundwater is frequently the result of improper storage and disposal of industrial, commercial and domestic wastes. Improper disposal practices include land dumping of barrels and disposal of untreated wastewater into septic systems, storm drains, sewers, streams and marshes. Few municipal wastewater treatment plants are equipped for the removal of organic solvents. Storage areas for drums and tanks are often inadequately constructed and maintained. They also may lack equipment to handle accidental spills and leaks.

Disposal of solvents into domestic septic systems or use of septic tank cleaners containing organic solvents also pose a threat to groundwater quality. The amount contributed by any one household is usually small, but the cumulative contribution of toxic organic solvents may have a significant effect on groundwater quality.

Table of Common Solvents and Uses

SOLVENTS	USES
Aromatic Hydrocarbons	
Naphthalene	Solvent, lubricant preservatives, fungicide, moth repellant
Toluene	Adhesive solvent in plastics, solvent, aviation and high octane blending stock, dilutant, thinner, detergents, chemicals, explosives
Benzene	Detergents, solvents, antiknock gasoline
Halogenated Hydrocarbons	
Tetrachloroethylene (Perchloroethylene, PCE)	Degreasers, dry cleaning, solvent, drying agents
1,1,1-Trichloroethane (TCA) 1,1,2-Trichloroethane	Pesticides, degreasers, solvents
Trichloroethylene (TCE)	Degreasers, paints, dry cleaning, dye stuffs
1,2-Dichloroethane (EDC)	Metal degreaser, insecticide fumigant, paint, varnish, and finish removers, soaps and scouring compounds
Vinyl Chloride	Used in the manufacture of vinyl chloride resins which are major components of plastics

Behavior/Fate of Solvents

- Volatize readily from surface water or from the upper level of the unsaturated zone.
- Solvents that reach lower levels of the unsaturated zone easily migrate to groundwater, wherein they are very mobile and persistent. Once in groundwater, a solvent's volatility is no longer a dominant factor in its removal. These compounds also persist because they are resistant to biodegradation processes.
- The products of partial degradation of solvent compounds may have their own toxic properties that could also pose a health threat.
- Some solvents which are more dense than water sink to the lower depths of an aquifer and possibly into bedrock, making contaminant pathways difficult to predict.
- Solvents are known to travel long distances and may reach a well from a land use outside the boundaries of a Zone II.

Sulfate

The sulfate ion, $(SO_4)^2$ and hydrogen sulfide (H_2S), a dissolved gas, are natural (background) constituents of groundwater. Both natural and pollutant species of organic sulfur compounds are commonly found in groundwater systems. The biodegradation of these compounds is an important process that can affect water quality. For example, hydrogen sulfide is a toxic and odoriferous (smells like rotten eggs) degradation product of organic sulfur compounds.

Chemical plants, textile mills, paper mills and tanneries produce wastes that may contain hydrogen sulfide. Some fertilizers and pesticides contain sulfate.

Because of its strong rotten egg odor, groundwater that contains hydrogen sulfide in concentrations greater than one milligram per liter (1 mg/l) is unfit for human consumption. Groundwater with sulfate concentrations above 250 mg/l will act as a laxative when ingested.

Surfactants/Detergents

Typical synthetic detergents - laundry detergents, automatic dishwasher powders and dishwashing liquids consist of three components:

1) surfactants
2) builders
3) fillers

Surfactants (also called "surface-active agents") are the actual cleansing ingredients in detergents. Surfactants have two distinct components: one is soluble in water, the other is insoluble in water. Surface-active agents concentrate at the interface between the surfactant solution and the other phase, i.e., air, soil, fabric, dish, or floor. By reducing the surface tension of the water, surfactants enable the detergent to penetrate and wet soiled surfaces and loosen or disperse the dirt.

Builders have little or no cleansing power. They make the surfactant perform better by binding up the iron, magnesium and calcium ions in the water that would normally interfere with the surfactant's cleansing power. The most common builders are phosphate compounds. These compounds create and maintain a proper alkalinity (high pH), and remove the dirt by keeping it suspended in the water.

Fillers generally dilute the product. Additives such as brighteners and perfumes are typical fillers.

Detergents are commonly found in industrial wastes due to their use as wetting agents, penetrants, emulsifiers and dispersants in the cosmetic, textile, metal, paint, and leather industries. **The presence of detergents in groundwater is an indicator of contamination by treated and untreated wastewater.**

VII. MASSACHUSETTS HAZARDOUS WASTE REGULATIONS

Under Federal and Massachusetts law, the Department of Environmental Quality Engineering (DEQE) is required to track the generation, storage, treatment, use and disposal of hazardous waste. The DEQE tracks hazardous waste from the "cradle to grave" with a computerized system and a special shipping document called a Uniform Hazardous Waste Manifest. A manifest assures the generator (who has ultimate legal responsibility for his hazardous waste) that the waste has been properly handled.

In order to use the manifest system, businesses must obtain a federal identification number by requesting a Notification of Hazardous Waste Activity Form from DEQE (617)-292-5898. The Environmental Protection Agency (EPA) normally issues identification numbers within 90 days. During the EPA processing time, generators can obtain a temporary number, that is specific to the generator's location not his waste, by calling the DEQE at 1-800-343-3420. Businesses should also obtain a manifest, identify their wastes and select a licensed transporter and hazardous waste disposal facility.

In Massachusetts, every shipment of hazardous waste by a large, small or very small generator must be:

- transported by a licensed waste hauler;
- sent to a licensed treatment, storage or disposal facility (TSD) or a permitted recycling facility;
- accompanied by a manifest.

However, Small Quantity Generator (SQG) that ships only waste oil or a Very Small Quantity Generator (VSQG) that ships waste oil and/or hazardous waste may use a transporter's log instead of a manifest. If a SQG or VSQG wishes to use a transporter's log, the generator must register with the DEQE. In the discussion below, the source of particular standards in the Code of Massachusetts Regulations (CMR) is listed in parentheses. The same convention is followed in the sections on Best Management Practices (BMPs).

Classification of Hazardous Waste

A waste is identified as hazardous if it is listed in the regulations (310 CMR 30.131-136) or has one or more of the specific characteristics listed below:

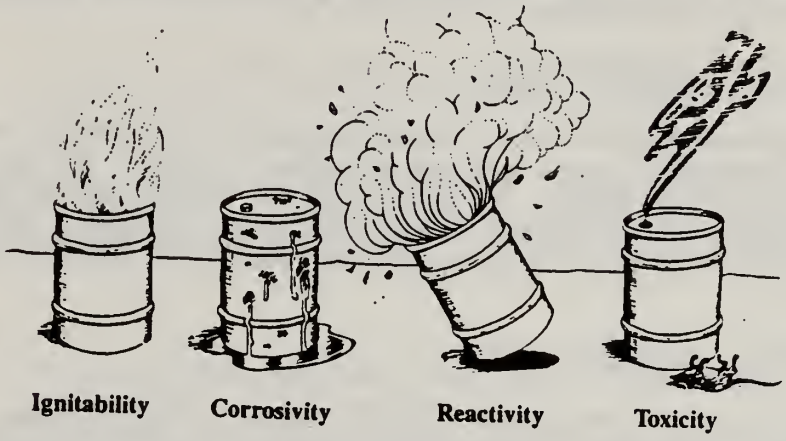
Ignitable - easily catches fire, flash point < 140 degrees F.

Corrosive - very acidic or alkaline, pH of less than 2 or greater than 12.5.

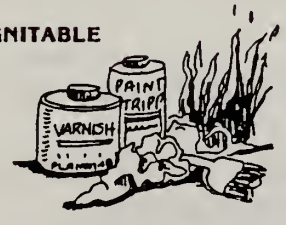
Reactive - explosive, produces toxic gases when mixed with water or acid.

Toxic - can leach toxic chemicals as determined by a special lab test.

Acutely hazardous wastes, listed in 310 CMR 30.136, are extremely toxic or reactive. Therefore, these wastes are regulated more strictly than other hazardous wastes.



SOURCE: U.S. Environmental Protection Agency, Office of Solid Waste November 1986.

	MEANS	SOME EXAMPLES
A. IGNITABLE 	Burns easily. Another common term is flammable.	waste oils, paint strippers, varnishes, certain pesticides
B. CORROSIVE 	Uses chemical action to eat through other materials.	many acids used in processes for metal plating and printing, common household items like drain cleaners.
C. REACTIVE AND EXPLOSIVE 	Chemically unstable to the point that violent changes occur when jarred, burned, heated or brought into contact with other substances.	unexploded munitions and ammunition; explosive gases like propane used in industry and the home; certain chemical compounds like nitroglycerin.

SOURCE: Maine Association of Conservation Commissions, 1983.

Hazardous Waste Generator Status

The rate at which a business generates waste and how much hazardous waste the business accumulates determines the generator status for that particular business.

Large Quantity Generators (LQG)

A LQG generates more than 1,000 kilograms (>2200 pounds or 250 gallons) of hazardous waste and one kilogram (1 quart) of acutely hazardous waste in a month. When the first 1,000 kilograms of waste has been accumulated the waste must be shipped via a licensed waste hauler within 90 days. There is no limit to the amount of waste that can be accumulated.

Small Quantity Generators (SQG)

A SQG generates less than 1,000 kilograms (< 250 gallons or 2200 pounds) and/or less than 1 kilogram of acutely hazardous waste in a month.

Very Small Quantity Generators (VSQG)

A VSQG generates less than 100 kilograms (< 25 gallons) of hazardous waste in a month and generates no acutely hazardous waste.

Waste oil is regulated separately from other hazardous wastes. Generator status is determined separately for hazardous waste and waste oil, i.e., a business may be a LQG of waste oil and a SQG of solvents.

Housekeeping

Accumulation Area Standards (310 CMR 30.351 [8])

Each business, regardless of generator status, that stores hazardous waste must meet the following standards for storage areas:

o Above-ground tanks and containers (i.e., 55 gallon drums) must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.

o The area must be secured against unauthorized entry.

o The area must be clearly marked (e.g., by a visible line or tape, or by a fence) and be separate from any points of generation.

o The area must be posted with a sign: "HAZARDOUS WASTE" in capital letters at least one inch high.

o An outdoor storage area must have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

- 10% of the total volume of the containers, or
- 110% of the volume of the largest container, whichever is larger.

Any spillage must be promptly removed. Generally, if the hazardous waste being stored has no free liquids, no pad or berm is required provided that the accumulation area is sloped or the containers are elevated.

Standards for Containers and Tanks (310 CMR 30.680, 30.690)

o Each container and tank and each outside container into which smaller containers are packed must be clearly and visibly labeled throughout the period of accumulation with the following:

- The words "Hazardous Waste."

- The hazardous waste(s) identified in words (e.g., acetone, toluene).

- The type of hazard(s) associated with the waste(s) indicated in words (e.g., ignitable, toxic, dangerous when wet).

- The date upon which each period of accumulation begins.

- Labels shall be placed on the sides of each tank or container in such a manner that they are clearly visible for inspection.

o Each tank must be in good condition.

o At least weekly, the owner or operator shall inspect areas where containers are stored, looking for leakage and for deterioration of containers and the containment system caused by corrosion or other factors. There must be enough aisle space between containers to allow for inspections.

o Wastes of different types must be segregated. For example, this includes not mixing waste oil or used fuel oil with other wastes.

o Containers of incompatible wastes must be separated by a berm, dike or similar structure.

o Each container holding hazardous waste must covered with a secure lid throughout the period of accumulation.

VIII. WASTE OIL

In Massachusetts, waste oil has been classified as a hazardous waste since 1973. Waste oil is the largest volume of hazardous waste by type in the state. Over 80,000 tons of waste oil are generated in one year (DEQE, 1988). The Department of Environmental Quality Engineering (DEQE) regulates the storage and disposal of all waste oil except that produced by households. Waste oil is regulated separately from other hazardous wastes. However, guidelines to determine generator status are similar to those for hazardous waste.

Large Quantity Generator (LQG)

A LQG is one that produces more than 2,200 pounds (approximately 250 gallons) of waste oil per month. LQG's may accumulate any amount, but are limited to 90 days of storage once the 2,200 pounds have been accumulated. LQG's must obtain an EPA Indentification Number and use a manifest when they ship their waste oil.

Small Quantity Generator (SQG)

SQG's produce less than 2,200 pounds (< 250 gallons) of waste oil per month. The SQG may accumulate up to 550 gallons in drums or 1,650 gallons in tanks for up to 180 days. SQG must use a manifest or transporter's log and ship their waste through a licenced hazardous waste transporter.

Very Small Quantity Generator (VSQG)

A VSQG is one that produces less than 220 pounds (< 25 gallons) of waste oil per month. A VSQG may accumulate up to 165 gallons for an unlimited period of time. A VSQG may transport waste oil to another generator or receiving facility. VSQG's may choose to use a manifest or transporter's log and a licensed waste hauler to dispose of waste oil.

UNDERGROUND TANKS STORING WASTE OIL

Tanks are considered to be underground when any portion is below ground or if the bottom is resting on the ground. Underground tanks are categorized as existing or new. Existing tanks are those installed before October 15, 1983 and new tanks are those installed on or after October 15, 1983.

General Operating Requirements For All Underground Waste Oil Tanks
(310 CMR 30.695 - 30.696)

The owner of the underground tank or an authorized representative must:

- o Prevent overfilling of tank by using appropriate controls and practices such as:
    - * Install a by-pass system to a standby tank
    - * Install a waste feed cut-off system

- o Check the tank at least once a day to ensure that it is in good working order.
    - * Inspect controls that prevent overfilling
    - * Gather data from temperature and pressure gauges or other monitoring equipment
- o Check the area around the tank at least once a week for obvious signs of leakage.

Labeling Waste Oil Tanks [310 CMR 30.340 (1) (b)]

- o Each tank must be clearly marked and labeled throughout the period of accumulation with a sign that reads:
    - * Hazardous Waste
    - * Waste Oil
    - * Toxic
    - * The date on which accumulation began

Testing Requirements for Existing Underground Waste Oil Tanks
[310 CMR 30.235 (1) (h) and 30.340 (1) (a) 2.b]

Leak Detection Tests are required for tanks installed before October 15, 1983 if they do not have a secondary containment system or monitoring system.

Dip Stick Test

A dip stick test must be conducted every 30 days. The owner of the tank or designated employee measures the height of the waste oil in the tank with a dip stick, seals the tank for 24 hours and then measures the level of oil again. If the difference in the oil levels measured is greater than 1/2 an inch, the test results must be immediately called in to the local fire chief and the nearest DEQE regional office. Written notice of the test results must be sent to the DEQE within 7 days.

Every 12 months a dip stick test must be performed except the tank must be sealed for 48 hours between measurements.

Dip stick test results must be recorded in a log, dated and signed by the tank owner or designated representative. All test records must be kept for at least 3 years, or for the duration of any enforcement action, or as requested by DEQE, whichever is longer.

Design Standards for New Underground Waste Oil Tanks
[310 CMR 30.253 (1) (g) and 30.340 (1) (a) 2.b]

Underground storage tanks installed after October 15, 1983 **must** meet one of two requirements.

1. The tank must be constructed of corrosion-resistant material such as fiberglass-reinforced plastic or externally coated or cathodically protected steel.

or

2. The tank must have a secondary containment structure and a monitoring system to detect leaks between the tank and the secondary containment structure and to detect water inflow.

In addition, the tank must be equipped with a striker plate to protect the tank bottom from wear or puncture during the dip stick test. There must also be a manhole large enough for a person to enter and inspect the tank.



SOURCE: U.S. Environmental Protection Agency, Office of Solid Waste November 1986.

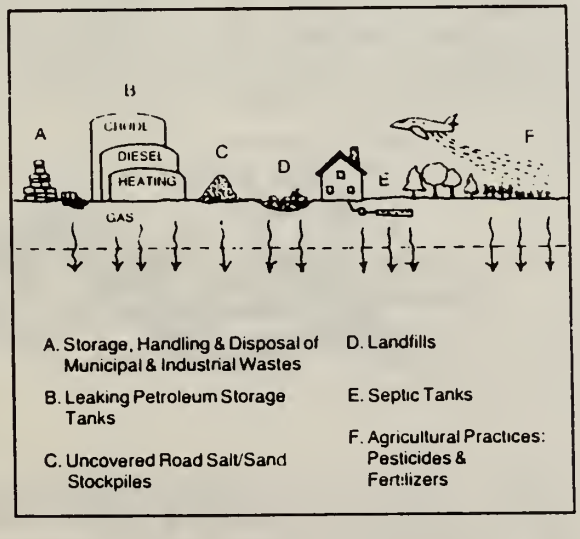
Description of Land Uses



IX. DESCRIPTION OF LAND USE CATEGORIES

This section contains detailed information for the land use categories listed in the Land Use/Public Supply Well Pollution Potential Matrix. Each category contains a description of the typical operating processes and procedures for that particular business or activity. Associated with these land use categories are various products that contain potential groundwater contaminants such as those listed in the Matrix. Every land use category has its own set of practices involving the use, storage, handling, and disposal of these products. These practices are described and followed by a list of Best Management Practices (BMPs) that can be used to mitigate the threat of groundwater contamination from the particular land use activity.

Best Management Practices can be written into permits and site plan reviews, and can be incorporated into a bylaw setting **environmental standards**. Environmental standards can be enacted to apply to a variety of land use activities. For example, standards can include specifications for hazardous materials storage and containment, storm water management, erosion and sedimentation controls, sand and gravel excavation, earth removal, and limits to lot coverage in order to minimize loss of recharge to groundwater (NEIWPCC, 1988). For additional information, please refer to Section X. **Local Regulatory Techniques.**



Many Activities Have the Potential to Contaminate Groundwater

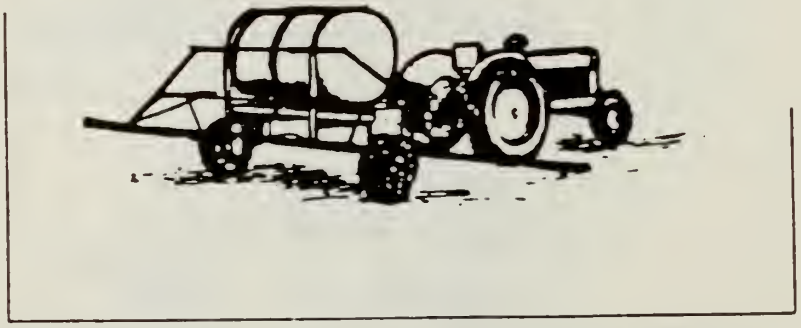
SOURCE: New England Interstate Water Pollution Control Commission, January, 1987.

Agricultural Cropland and Golf Courses

Farmers apply pesticides to agricultural land to control crop diseases, kill insects and destroy weeds. Fertilizers are also applied to the land to provide nutrients to the soil for better crop growth. Grounds-keepers tending golf courses use pesticides and fertilizers in a similar manner to enhance the growth and appearance of the fairways, greens and other turf. Agricultural cropland and golf courses are major sources of pesticides and nitrates due to the large amount of treated land, application procedures and irrigation practices.

Once applied, pesticides can dissolve and be carried over the ground with runoff from precipitation and irrigation and enter the groundwater via man-made conduits such as drainage wells and ditches, filtration basins and wells. Pesticides can also leach from the soils to the groundwater (please refer to section on Pesticides). In April, 1984, the DEQE closed three gravel-packed wells that supplied 5.0 mgd to West Springfield, Massachusetts due to contamination by the fumigant ethylene dibromide (EDB). In Massachusetts, some of the pesticides that have been found in at least one location in groundwater include: Alachlor, Dinoseb, Carbofuran, Aldicarb, EDB, Oxamyl, 1,2-D and 1,3-D.

Fertilizers contain organic, inorganic and synthetic compounds that supplement the soil's supply of nutrients, making it more fertile. The plant nutrients found in fertilizers are ions that are easily absorbed by plant roots. One of the nutrients in fertilizers, nitrogen, is of particular concern with respect to groundwater quality. Nitrogen that is not taken up by plants and bacteria or volatilized, leaches out of the soil as nitrate nitrogen (NO_3^-) which is highly soluble and mobile in soils and groundwater (see section on Nitrates).



Boom sprayer—Used to apply liquid pesticide for agriculture, turf, and nursery crops.

SOURCE: Massachusetts Audubon Society, Groundwater Information Flyer #7, November 1985.

BEST MANAGEMENT PRACTICES
Agricultural Land and Golf Courses

To reduce the threat of groundwater contamination from agricultural cropland and golf courses, local officials should be aware of pesticide and fertilizer use on those lands located within the recharge areas of their public supply wells. The following BMPs emphasize proper land management to reduce runoff and soil losses as well as careful pesticide and fertilizer use. For information on BMPs for animal wastes, please refer to the BMP section under Stables and Animal Feedlots.

Erosion and Runoff Control Practices

The USDA Soil Conservation Service, the Cooperative Extension Service and the Agricultural Stabilization and Conservation Service (ASCS) provide technical assistance for BMP that apply to agricultural lands and large turf areas. Currently, the UMASS Cooperative Extension Service is developing a database on soil types, pest problems and the characteristics of the pesticides used in Massachusetts (i.e., "leachers"). This database will enable the Cooperative Extension Service to analyze a farmer's soil sample and pest problem and then make specific recommendations for the type of pesticide to use and the appropriate application method.

The list of BMP included in this handbook is not complete. BMPs have been compiled from several sources. Readers are advised to check with their local Extension Agents and state agencies for up-to-date and site specific BMPs. The technical expertise of the agencies mentioned above is necessary to adapt and implement BMP to site characteristics and specific problems. For example, the use of a BMP to control runoff and increase infiltration rates may be detrimental to groundwater quality. If pesticides or fertilizers with soluble and mobile components ("leachers") are used in conjunction with a BMP to reduce runoff, the infiltrating water may be contaminated. However, reducing runoff and sediment losses will reduce the transport of pesticides that are bound to soil particles.

Examples of BMP to Control Erosion and Runoff (USDA, 1984)

- Conservation Tillage
- Stripcropping
- Filter Strips
- Sediment Basins
- Contouring
- Grassed Waterways
- Cover Crops

Fertilizer Management (USDA, August 1984)

The method of fertilizer application is important. Several factors should be considered before fertilizer is applied:

1. Type of crop or turf
2. Method and timing of application
3. Weather conditions
4. Soil characteristics
5. Fertilizer application should be based on a current soil test (one taken within the last 12 months).
6. Fall application of nitrogen on sandy soil should be avoided.
7. A winter cover crop should be established where needed.

BEST MANAGEMENT PRACTICES
Agricultural Land and Golf Courses

Pesticide Management

1. Chemicals used must be registered at the Federal, state and local level.
2. Chemicals must be applied strictly in accordance with authorized uses, label directions and other Federal or state policies and requirements.
3. Spray equipment should be properly calibrated and maintained.
4. Rinsewater from containers and application equipment can be diluted and spread on crops or turf.
5. Check-valves should be installed in irrigation systems that inject chemicals into irrigation water to prevent backflow of the pesticides into the system.
6. Banned or outdated pesticides should be disposed of through a licensed hazardous waste transporter.

Pesticide formulation can have a considerable impact on loss by various transport routes (USDA, September 1984). The Extension Service recommends that the following guidelines be followed to aid in the selection of pesticide formulation and application methods.

1. Wettable powders and microgranules are considered to be the most susceptible to runoff losses.
2. Dusts, wettable powders and fine liquid sprays have the greatest drift losses.
3. Aqueous solutions, liquid and liquid concentrates, especially when applied as fine sprays, have very high losses due to volatilization.
4. The use of granules, pellets and emulsions reduce losses by volatilization and drift.

The amount of pesticides applied to crops and turf areas can be reduced by improving the application efficiency, using non-chemical control measures (integrated pest management) and substituting less toxic, less persistent and less mobile pesticides whenever possible.

Pesticide and Fertilizer Storage Areas

- Outdoor storage facilities should have a permanent roof to prevent precipitation and sunlight from entering the storage area.

- Outdoor storage facilities should have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

    * 10% of the total volume of the containers, or
    * 110% of the volume of the largest container, whichever is larger.

- Above-ground tanks and containers should be stored on an impervious surface (i.e., a coated concrete pad) that is free of cracks and gaps.

BEST MANAGEMENT PRACTICES
Agricultural Land and Golf Courses

- Indoor storage areas for tanks and drums should be clearly marked and separate from work areas. Storage areas should not be located near floor drains.

- Mixing areas for pesticides should be located indoors, away from floor drains.

- Any floor drains located in buildings used for storage or mixing of pesticides and fertilizers should be connected to a holding tank not a septic system or sanitary sewer.

- Wastes collected in a holding tank must be disposed of through a licensed hazardous waste transporter.

Disposal of Pesticide and Fertilizer Wastes

The use of pesticides and fertilizers generates several different types of wastes: leftover or unusable pesticides and fertilizers, empty containers and rinsewater. DEQE's hazardous waste regulations (310 CMR 30.00) govern the disposal of pesticides and other hazardous wastes. **However, the leftover pesticides, fertilizers and rinsewaters are not regulated by the state.** Please contact the DEQE Division of Hazardous Waste for further information. Pesticide use by homeowners is not regulated by the state. Homeowners should exercise extreme caution and carefully follow all label directions. Leftover pesticides should be disposed of through an organized Household Hazardous Waste Collection Day (contact Barbara Kelley, DEM Office of Safe Waste Management (617) 727-3260).

- Leftover pesticides (as long as they are not banned or restricted) and rinsewaters from container or equipment cleaning should be diluted and spread on the land as needed. Follow all label directions.

- Pesticide containers can be disposed of in landfills if they are emptied in accordance with hazardous waste regulations. Containers can be triple-rinsed and the residue from rinsing can then be applied (according to label directions) to the land when needed .

- Pesticide containers can be emptied in accordance with state hazardous waste regulations and disposed of in a sanitary landfill. Paper bags are considered "empty" if they have been shaken to remove all wastes to the extent feasible or if the liner has been removed. A container is considered "empty" is no more than one inch of residue remains in the bottom or if it has been rinsed with an effective solvent or cleaned an approved method.

- Bags and containers that held acutely hazardous waste as defined by DEQE must be disposed of through a licensed hazardus waste transporter.

INTEGRATED PEST MANAGEMENT

The use of pesticides should be a part of an overall pest management strategy that includes biological controls, cultural methods, pest monitoring and other practices. Integrated Pest Management (IPM) is an interdisciplinary approach to pest management and crop production that incorporates the following approaches:

- Pest identification and monitoring
- Economics of crop production and pest management
- Proper horticultural, soil management and pesticide application practices
- A "least is best" pesticide strategy
- Pesticide selection and safety
- Use of biological controls

Since 1978, the University of Massachusetts Cooperative Extension has conducted IPM programs in Massachusetts for apples, cranberries, potatoes, sweet corn, turf and strawberries.

Apple IPM

The Apple IPM program, begun in 1978, is now in the maintenance phase. Stage I is complete and Stage II is in a pre-pilot phase. Stage I of the apple IPM resulted in approximately a 40% reduction in pesticide use in the participating orchards compared to useage prior to 1978 (UMASS Cooperative Extension, 1987). Stage II is a more holistic and innovative orchard management strategy that includes reducing and intercepting immigrating pests at the orchard perimeter, using enhanced biological controls, mating disruption and other novel techniques. The goal of Stage II apple IPM is to reduce insecticide and miticide use by up to 70% compared to 1978 levels.

Cranberry IPM

Cranberries are the state's most valuable agricultural commodity. The 1986 cranberry crop was the largest in Massachusetts' history with total earnings of $91 million (UMASS Cooperative Extension, 1987). Thirty-one (31) growers with a total of 416 acres of bog participated in the 1987 IPM program. IPM growers receiving scouting services and spray recommendations applied fewer numbers and/or a lower dosage equivalent of insecticide than non-IPM growers.

Potato IPM

In 1987, 395 acres of commercial potatoes on 18 farms were enrolled in the potato IPM program. Based on the results of the UMASS Cooperative Extension 1987 IPM program, participating IPM growers used approximately 2.6 fewer insecticide applications against the Colorado potato beetle and aphids compared to pre-IPM surveys with no reduction in crop yield.

Sweet Corn IPM

Nineteen commercial growers with 1200 acres of sweet corn participated in the 1987 sweet corn IPM. The results of the 1987 program are not available at this time however, the 1986 program participants had a 36.9% reduction in the number of spray treatments compared to non-IPM growers.

Turf IPM

In 1986, the first year of Turf IPM, 66 homeowners in the Amherst and Springfield area participated in the program. Scouts visited the turf areas from mid-May to mid-September. The scouts emphasized proper cultural practices and diagnosed and monitored insect, weed and disease pests. Most diagnosed pests and diseases did not require pesticide application while persistent weeds did require treatment.

The program results determined that a typical IPM participant could save between $140.00 to $200.00 by enrolling in the IPM program rather than using a professional lawn care service. The Turf IPM coordinators reported that interest in the program is high. They anticipate having 300 participants for the 1987 program. More importantly, the program coordinators "...believe that demonstrating a high level of homeowner interest in IPM for turf will convince commercial lawn care companies to offer a scouting service as an alternative to regular calender-based lawn treatments...."

In the second year of Turf IPM, 135 participants in the metropolitan Boston area enrolled in the 1987 Turf IPM program. These participants applied an average of about 50% fewer fertilizer and pesticide sprays than homeowners contracting with commercial firms (UMASS Cooperative Extension, 1987).

Strawberry IPM

According to the UMASS Cooperative Extension, there is a strong incentive to develop IPM strategies for strawberry growers based on the following facts:

1. Strawberries are a pesticide-intensive crop.
2. Several registered strawberry pesticides are no longer available for use and no alternative pesticides are available at this time.
3. Possible public exposure to pesticides in "pick-your-own" strawberry blocks.

The strawberry IPM program is in its first year of pre-pilot activity. Baseline weather and pest data is being collected and control and sampling techniques are being developed. In addition, a survey sent to 300 growers will provide data on current practices and perceived pest management needs.

Airports

Maintenance facilities for aircraft and other airport vehicles generate wastes that are potential groundwater contaminants including waste oil, gasoline, hydraulic fluid, cleaning lubricants, degreasing solvents, used batteries, tires, and broken or junk metal airplane parts. Some common maintenance practices include spraying degreasing solvent on aircraft engines, changing oil, batteries, hydraulic fluid and lubricants. Fuel trucks refuel many of the planes at the loading gates. Jet fuel is also drained and replaced in the maintenance hangars.

To train fire crews at airports, gasoline/petroleum products are sometimes poured onto the ground and set ablaze. Once in contact with the ground, these contaminants can migrate down through the soil into the groundwater.

Airport workers apply pesticides and herbicides to areas surrounding the runways to keep the plant and weed growth to a minimum.

Storage areas for the petroleum products, solvents, pesticides and road salt used by the airport workers are a potential threat to groundwater quality. Underground storage tanks (UST) containing jet fuel, gasoline, diesel fuel, heating oil and solvents are a major threat to groundwater if they are old, rusting or leaking (please see section on Underground Storage Tanks). Raw materials and wastes stored in 55 gallon drums should be tightly covered and placed on an impermeable surface to prevent leaks and spills from infiltrating the soil. Outdoor storage facilities should be protected from rain, sun and other precipitation.

Improper use and disposal of these products may contaminate groundwater. Spills that occur during refueling or the spraying of degreasing solvent on engines and parts should be contained immediately and cleaned up. Leftover paint, rags contaminated with solvents, oil or paint, and speedy dry used to absorb oil and other liquids should be handled as hazardous waste and disposed of through a licensed waste hauler.

BEST MANAGEMENT PRACTICES
Airports

Waste Type [1]	Management
Oil Diesel Fuel	Do not mix the waste with anything, e.g., kerosene or gasoline
Solvents (thinner or degreaser)	Store in tightly covered containers
Gasoline	Store containers as full as possible to prevent vapors and the chance of explosion
Batteries	If the batteries are cracked and leaking acid, they are a hazardous waste and must be shipped with a manifest via a DEQE-licensed hazardous waste transporter. To avoid leakage, batteries should be stored on pallets, banded and protected from the elements and unauthorized handling. Batteries that remain intact are not a hazardous waste and can be transported as a hazardous material to a reclaimer. Reclaimers may not be willing to accept small numbers of batteries. It is recommended that businesses work with distributors that will accept dead batteries in exchange for new ones.

- Floor drains in maintenance bays should be connected to a holding tank or sanitary sewer equipped with an oil and grit separating tank.
- Wastes collected in a holding tank must be disposed of through a licensed hazardous waste transporter.
- Large drip pans should be kept beneath the spigots of drums that are stored in a horizontal position on racks.

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[1] adapted from the Massachusetts Department of Environmental Quality Engineering, Division of Hazardous Waste Fact Sheets for various businesses.

BEST MANAGEMENT PRACTICES
AIRPORTS

- Cleaning rags contaminated with paint, solvents, oil or gasoline should be recycled through a rag rental/cleaning service.

- Outdoor storage facilities should have a permanent roof to prevent precipitation and sunlight from entering the storage area.

STANDARDS FOR HAZARDOUS WASTE ACCUMULATION AREAS
(310 CMR 30.351 [8])

- Above-ground tanks and containers must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.

- Accumulation area must be secured against unauthorized entry.

- Accumulation area must be clearly marked (e.g., by a visible line or tape, or by a fence) and be separate from any points of generation.

- Accumulation area must be posted with a sign: "HAZARDOUS WASTE" in capital letters a least one inch high.

- An outdoor accumulation area must have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

  10% of the total volume of the containers, or
  110% of the volume of the largest container, whichever is larger.

STANDARDS FOR CONTAINERS AND TANKS
(310 CMR 30.680, 30.690)

- Each container (i.e, a 55 gallon drum) and tank must be clearly and visibly labeled throughout the period of accumulation with the following:

  - the words "HAZARDOUS WASTE"
  - the name of the waste (e.g., waste oil, acetone)
  - the type of hazard(s) (e.g., ignitable, toxic)
  - date on which accumulation began

- Each container must be in good condition.

- Wastes of different types must be segregated.

- Incompatible wastes must be separated by a berm, dike or similar structure.

- Each container holding hazardous wastes must be tightly closed throughout the period of accumulation, except when the waste is being added or removed.

BEST MANAGEMENT PRACTICES
Airports

- Accumulation areas must be inspected at least once a week for signs of leaks or spills. The aisle space between containers must be adequate to allow for inspections.

UNDERGROUND TANKS STORING WASTE OIL

Tanks are considered to be underground when any portion is below ground or if the bottom is resting on the ground. Underground tanks are categorized as **existing** or **new**. Existing tanks are those installed before October 15, 1983 and new tanks are those installed on or after October 15, 1983.

General Operating Requirements For All Underground Waste Oil Tanks
(310 CMR 30.695 - 30.696)

The owner of the underground tank or an authorized representative must:

- Prevent overfilling of tank by using appropriate controls and practices such as:
  - * Install a by-pass system to a standby tank
  - * Install a waste feed cut-off system
- Check the tank at least once a day to ensure that it is in good working order.
  - * Inspect controls that prevent overfilling
  - * Gather data from temperature and pressure gauges or other monitoring equipment
- Check the area around the tank at least once a week for obvious signs of leakage.

Labeling Waste Oil Tanks [310 CMR 30.340 (1) (b)]

- Each tank must be clearly marked and labeled throughout the period of accumulation with a sign that reads:
  - * Hazardous Waste
  - * Waste Oil
  - * Toxic
  - * The date on which accumulation began

Testing Requirements for Existing Underground Waste Oil Tanks
[310 CMR 30.235 (1) (h) and 30.340 (1) (a) 2.b]

Leak Detection Tests are required for tanks installed before October 15, 1983 if they do not have a secondary containment system or monitoring system.

Dip Stick Test

A dip stick test must be conducted every 30 days. The owner of the tank or designated employee measures the height of the waste oil in the tank with a dip stick, seals the tank for 24 hours and then measures the level of oil again. If the difference in the oil levels measured is greater than 1/2 an inch, the test results must be immediately called in to the local fire chief and the nearest DEQE regional office. Written notice of the test results must be sent to the DEQE within 7 days.

Every 12 months a dip stick test must be performed except the tank must be sealed for 48 hours between measurements.

Dip stick test results must be recorded in a log, dated and signed by the tank owner or designated representative. All test records must be kept for at least 3 years, or for the duration of any enforcement action, or as requested by DEQE, whichever is longer.

Design Standards for New Underground Waste Oil Tanks
[310 CMR 30.253 (1) (g) and 30.340 (1) (a) 2.b]

Underground storage tanks installed after October 15, 1983 must meet one of two requirements.

1. The tank must be constructed of corrosion-resistant material such as fiberglass-reinforced plastic or externally coated or cathodically protected steel.

or

2. The tank must have a secondary containment structure and a monitoring system to detect leaks between the tank and the secondary containment structure and to detect water inflow.

In addition, the tank must be equipped with a striker plate to protect the tank bottom from wear or puncture during the dip stick test. There must also be a manhole large enough for a person to enter and inspect the tank.

Asphalt Plants

Asphalt plants are generally located near quarries where workers mine sand, gravel and other aggregate material. The aggregate is sorted, dried in a kiln and sorted again to meet the size specifications of each job. Oil and asphalt emulsions are then blended with the sorted aggregate to produce asphalt. Soil contaminated with oil from leaking underground storage tanks is used as aggregate by some plants. In addition, the soil to be used by the asphalt plants can contain no more than 3% free liquids (no floating oil or oil sheen).

The oil and asphalt emulsions used in the batching process and the fuel oil used to fire the kiln that are stored in underground tanks, aboveground tanks or 55 gallon drums may be a threat to groundwater quality if the underground tanks are old or leaking or if the storage areas for the aboveground tanks and drums do not have an impervious floor, a roof and berms to contain spills.

BEST MANAGEMENT PRACTICES
Asphalt Plants

- Storage areas for contaminated soil are strictly regulated by DEQE. These areas must have an impervious floor, berms to contain spills, a leachate collection system and a roof.

HAZARDOUS WASTE ACCUMULATION AREA STANDARDS
(310 CMR 30.351 [8])

- Above-ground tanks and containers must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.

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Asphalt Plants

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In addition, the tank must be equipped with a striker plate to protect the tank bottom from wear or puncture during the dip stick test. There must also be a manhole large enough for a person to enter and inspect the tank.

Boat Yards/Builders

Boat yards maintain, repair and construct wooden and fiberglass boats. Routine maintenance performed on motors generates waste engine oil, antifreeze, batteries and spent gasoline/oil mixtures. Hydrochloric and phosphoric acid solutions may be used to clean and polish metal fixtures on the boats. The raw materials used in these procedures and the resulting wastes are potential groundwater contaminants. The wastes should be disposed of through a licensed hazardous waste hauler. Liquid wastes such as the antifreeze (contains ethylene glycol), petroleum products and acid solutions should be stored in 55 gallon drums or other leakproof containers fitted with secure lids to prevent spills and leaks. Drums and containers should be placed on an impervious surface to prevent spills from entering the soil.

Typical raw materials required to repair or build wooden and fiberglass boats include: fiberglass, resins, treated lumber, solvents and paints. Wastes generated during the repair process are spent resins, stained, painted or treated wood, used paint thinner, stripper, paint brushes, rollers, spray equipment and paint sludges. These wastes are potential groundwater contaminants due to the **phenols** contained in resins, **heavy metals** in paints, **solvents** in thinners and strippers and wood preservatives such as **creosote** and **pentachlorophenol** in the lumber. Liquid and solid wastes should be properly stored and disposed of through a licensed waste hauler. Spent resins, paint sludges, rags contaminated with solvents or paints and discarded lumber that are dumped on-site or stored in an area open to the elements pose a threat to groundwater quality. Rainwater and melting snow running over these wastes will cause the phenols, heavy metals and other toxic constituents to leach from the wastes into the soils and groundwater.

BEST MANAGEMENT PRACTICES
Boat Yards and Builders

- Wastes should be stored in 55 gallon drums or other leakproof containers. Drums and containers should be fitted with secure lids to prevent spills, leaks and the introduction of precipitation.

- Outdoor storage facilities should have a permanent roof to prevent precipitation and sunlight from entering the storage area.

- Paint guns should be cleaned in a container to prevent groundwater contamination. A high quality solvent should be used so they can be recycled. Use two cleaning tubs; one with clean solvent and one with "dirty" solvent. Wash the spray equipment in the dirty tub first. Another option is a commercial gun washing system.

- Rags contaminated with paint, solvents, grease or oil should be sent to a rag rental/recycling facility.

- Boat Yard owners are responsible for the hazardous wastes generated by their "do-it-yourself" customers. Owners should post signs and train an employee to be responsible for assisting customers.

BEST MANAGEMENT PRACTICES
Boat Yards and Builders

Waste Type	Management
Oil Diesel Fuel	Do not mix the waste with anything, e.g., kerosene or gasoline
Solvents (thinner or degreaser)	Store in tightly covered containers
Gasoline and Water	Store containers as full as possible to prevent vapors and the chance of explosion
Paint chips	Catch the chips in a tarp. Paint chips from metal-based paint may contain lead, chromium, barium, or arsenic. These chips must be disposed of as a hazardous waste unless an EP Toxicity test proves that they are non-hazardous.
Batteries	If the batteries are cracked and leaking acid, they are a hazardous waste and must be shipped with a manifest via a DEQE-licensed hazardous waste transporter. To avoid leakage, batteries should be stored on pallets, banded and protected from the elements and unauthorized handling. Batteries that remain intact are not a hazardous waste and can be transported as a hazardous material to a reclaimer. Reclaimers may not be willing to accept small numbers of batteries. It is recommended that Boat Yards work with distributors that will accept dead batteries in exchange for new ones.
Oil Contaminated Soil and Clean-up Debris	Must be handled as a hazardous waste.
Antifreeze	Although antifreeze is not listed as a hazardous waste, it can **contaminate groundwater**. Antifreeze should be shipped with the hazardous waste transporter as a "non-hazardous" waste or taken to a hazardous waste facility. Antifreeze **may not** be disposed of in a landfill or septic system.

For tanks and drums that contain waste oil and other petroleum products, spent solvents, sludges and spent acid solutions, the storage facilities must incorporate the following design standards:

HAZARDOUS WASTE ACCUMULATION AREA STANDARDS
(310 CMR 30.351 [8])

- o Above-ground tanks and containers must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.

- o Accumulation area must be secured against unauthorized entry.

- o Accumulation area must be clearly marked (e.g., by a visible line or tape, or by a fence) and be separate from any points of generation.

- o Accumulation area must be posted with a sign: "HAZARDOUS WASTE" in capital letters a least one inch high.

- o An outdoor accumulation area must have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

  10% of the total volume of the containers, or
  110% of the volume of the largest container, whichever is larger.

STANDARDS FOR CONTAINERS AND TANKS
(310 CMR 30.680, 30.690)

- o Each container and tank must be clearly and visibly labeled throughout the period of accumulation with the following:

  - the words "HAZARDOUS WASTE"
  - the name of the waste (e.g., waste oil, acetone)
  - the type of hazard(s) (e.g., ignitable, toxic)
  - date on which accumulation began

- o Each container must be in good condition.

- o Wastes of different types must be segregated.

- o Incompatible wastes must be separated by a berm, dike or similar structure.

- o Each container holding hazardous wastes must be tightly closed throughout the period of accumulation, except when the waste is being added or removed.

- o Accumulation areas must be inspected at least once a week for signs of leaks or spills. The aisle space between containers must be adequate to allow for inspections.

Car Washes

Automatic car wash operations are equipped with large, rotating brushes and high pressure soap, rinsewater, and wax spigots. Self-service bays may be drive-in, covered areas or located outside on a small, paved bay. The cleaning apparatus is usually a pressurized spray "gun" that dispenses a soap solution, rinsewater, and wax solution. Soap solutions used by car wash businesses usually contain a degreasing solvent such as methylene chloride or trichloroethylene (TCE) to enhance the cleansing ability of the soap solution.

The DEQE no longer grants discharge permits to new car washes in unsewered areas. However, wastewater from existing car wash operations contains several potential groundwater contaminants and therefore, is a threat to groundwater quality. Car washes generate a significant quantity of wastewater contaminated with sodium and chloride from road salt, oil, gasoline and grease from the undercarriage of the vehicle, solvents from the soap solutions, trace metals, and detergents.

BEST MANAGEMENT PRACTICES
Car Washes[2]

- In areas where connection to a sanitary sewer is available, interior floor drains should contain an oil/water separation system which includes a collection tank which separates sand/grit and oil/grease from the wastewater before discharging the wash water into the sewer system. Periodically (6 - 12 months) the tank should be emptied by a licensed hazardous waste transporter.

- In areas where connection to a sanitary sewer is not available, new car wash operations are not permitted by the DEQE Division of Water Pollution Control. Existing facilities should install a holding tank, similar to the oil/water separation system, but without provisions for discharge of the wastewater. The contents of the tank must be removed by a licensed waste oil hauler. The rinsewater should be recycled into the soap operation. Typical volume of the holding tank, with partial recycling, ranges from 4,000 to 5,000 gallons.

- Dry wells should never be used for wastewater disposal.

- Facilities should not provide steam cleaning or other engine cleaning services. Such operations can increase runoff of oil and degreasing solvents. This is of particular concern with self-service car washes, where patrons have the opportunity to clean the engine of a vehicle. Automated operations only wash the outside of the vehicle.

- The entrance of drive-in bays of self-service operations should be designed with a lip to contain wastewater and divert it into the oil/water separation system.

- Facility should maximize the recycling of rinsewater.

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[2] adapted from recommendations made by the State of Connecticut, Department of Environmental Protection, Water Compliance Unit.

Cemeteries

Leachate from cemeteries may contaminate groundwater if non-leak-proof or no caskets were used. Pesticides and fertilizers applied to trees, shrubs and grass during routine landscaping and maintenance operations may leach into the groundwater. Also, formaldehyde from embalmed corpses has been a source of contamination. Several site-specific factors affect leachate production including the soil type, depth to water table and amount of precipitation. Cemeteries located in areas that have a high water table and receive high amounts of precipitation may release contaminants to the ground water system.

In areas with thin soil cover over the bedrock, groundwater quality may also be degraded by cemetery leachate. According to the EPA, few actual cases of groundwater contamination due to cemeteries have been documented. In most instances, groundwater contamination due to cemetery leachate would be highly localized.

BEST MANAGEMENT PRACTICES
Cemeteries

Fertilizer Management

The method of fertilizer application is important. Several factors should be considered before fertilizer is applied:

1. Type of turf
2. Method and timing of application
3. Weather conditions
4. Soil characteristics
5. Fertilizer application should be based on a current soil test (one taken within the last 12 months).
6. Fall application of nitrogen on sandy soil should be avoided.

Pesticide Management

1. Chemicals used must be registered at the Federal, state and local level.
2. Chemicals must be applied strictly in accordance with authorized uses, label directions and other Federal or state policies and requirements.
3. Spray equipment should be properly calibrated and maintained.
4. Rinsewater from containers and application equipment can be diluted and spread on turf.
5. Check-valves should be installed in irrigation systems that inject chemicals into irrigation water to prevent backflow of the pesticides into the system.
6. Banned or outdated pesticides should be disposed of through a licensed hazardous waste transporter.

Pesticide formulation can have a considerable impact on loss by various transport routes (USDA Extension Service, 1984). The Extension Service recommends that the following guidelines be followed to aid in the selection of pesticide formulation and application methods.

1. Wettable powders and microgranules are considered to be the most susceptible to runoff losses.
2. Dusts, wettable powders and fine liquid sprays have the greatest drift losses.
3. Aqueous solutions, liquid and liquid concentrates, especially when applied as fine sprays, have very high losses due to volatilization.
4. The use of granules, pellets and emulsions reduce losses by volatilization and drift.

The amount of pesticides applied to turf areas can be reduced by improving the application efficiency, using non-chemical control measures (integrated pest management) and substituting less toxic, less persistent and less mobile pesticides whenever possible.

BEST MANAGEMENT PRACTICES
Cemeteries

Pesticide and Fertilizer Storage Areas

- Outdoor storage facilities should have a permanent roof to prevent precipitation and sunlight from entering the storage area.

- Outdoor storage facilities should have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

    * 10% of the total volume of the containers, or
    * 110% of the volume of the largest container, whichever is larger.

- Above-ground tanks and containers should be stored on an impervious surface (i.e., a coated concrete pad) that is free of cracks and gaps.

- Indoor storage areas for tanks and drums should be clearly marked and separate from work areas. Storage areas should not be located near floor drains.

- Mixing areas for pesticides should be located indoors, away from floor drains.

- Any floor drains located in buildings used for storage or mixing of pesticides and fertilizers should be connected to a holding tank not a septic system or sanitary sewer.

- Wastes collected in a holding tank must be disposed of through a licensed hazardous waste transporter.

Disposal of Pesticide and Fertilizer Wastes

The use of pesticides and fertilizers generates four different types of wastes: leftover or unusable pesticides and fertilizers, empty containers and rinsewater. DEQE's hazardous waste regulations (310 CMR 30.00) govern the disposal of pesticides and other hazardous wastes. However, the leftover pesticides and fertilizers and rinsewaters are not regulated by the state.

- Leftover pesticides (as long as they are not banned or restricted) should be disposed of by diluting the pesticide in the application tank and spraying it on the land. Follow all label directions.

- Pesticide containers can be disposed of in landfills if they are emptied in accordance with hazardous waste regulations. Containers can be triple-rinsed and with the residue from rinsing applied to the land when needed (according to label directions).

BEST MANAGEMENT PRACTICES
Cemeteries

- Paper bags are considered "empty" if they have been shaken to remove all wastes to the extent feasible or if the liner has been removed.

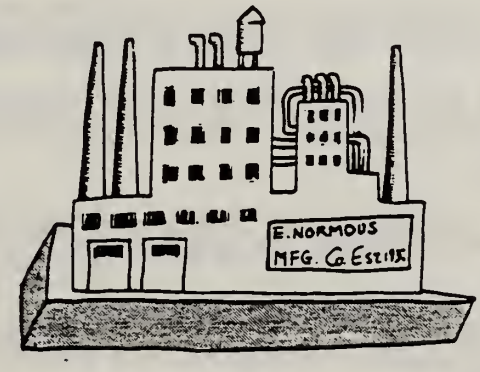
- Bags and containers that held acutely hazardous waste as defined by DEQE must be disposed of through a licensed hazardus waste transporter.

- Rinsewaters from container or equipment cleaning should be diluted and spread on the land.

Chemical Manufacture

Businesses that manufacture industrial organic and inorganic chemicals, plastics, pigments, pesticides, synthetic rubber and fibers, explosives or gum and wood chemicals are some examples of the chemical manufacturing land use category. A discussion of the wide range of processes and products used by these industries is beyond the scope of this handbook. However, some generalizations can be made concerning the types of wastes generated by these businesses.

Typical wastes produced by these plants include wastewater treatment sludges, spent solvents, emission control sludges, container residues, distillation residues, unused chemicals, waste heavy metal catalysts from plastic materials and strong acid or base solution wastes. The following table lists some common wastes generated by chemical manufacturing plants. Please refer to appropriate discussions in the Contaminant section for additional information.



SOURCE: U.S. Environmental Protection Agency, Office of Solid Waste November, 1986.

Waste Type

Spent Solvents	Acid/Base Wastes
Benzene	Hydrochloric Acid (HCL)
Toluene	Nitric Acid (HNO_2)
Xylene	Sulfuric Acid (H_2SO_4
1,1,1-Trichloroethane	Sodium Hydroxide (NaOH)
Trichloroethylene	Potassium Hydroxide (KOH)
Perchloroethylene	
Tetrachloroethylene	
Vinyl Chloride	

Spent Catalysts

Heavy metal sludges that contain Cadmium, Cobalt, Manganese and/or Zinc

BEST MANAGEMENT PRACTICES
Chemical Manufacture

STANDARDS FOR HAZARDOUS WASTE ACCUMULATION AREAS
(310 CMR 30.351 [8])

- Above-ground tanks and containers must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.

- Accumulation area must be secured against unauthorized entry.

- Accumulation area must be clearly marked (e.g., by a visible line or tape, or by a fence) and be separate from any points of generation.

- Accumulation area must be posted with a sign: "HAZARDOUS WASTE" in capital letters a least one inch high.

- An outdoor accumulation area must have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

  10% of the total volume of the containers, or
  110% of the volume of the largest container, whichever is larger.

STANDARDS FOR CONTAINERS AND TANKS
(310 CMR 30.680, 30.690)

- Each container (i.e, a 55 gallon drum) and tank must be clearly and visibly labeled throughout the period of accumulation with the following:

  - the words "HAZARDOUS WASTE"
  - the name of the waste (e.g., waste oil, acetone)
  - the type of hazard(s) (e.g., ignitable, toxic)
  - date on which accumulation began

- Each container must be in good condition.

- Wastes of different types must be segregated.

- Incompatible wastes must be separated by a berm, dike or similar structure.

- Each container holding hazardous wastes must be tightly closed throughout the period of accumulation, except when the waste is being added or removed.

- Accumulation areas must be inspected at least once a week for signs of leaks or spills. The aisle space between containers must be adequate to allow for inspections.

BEST MANAGEMENT PRACTICES
Chemical Manufacture

UNDERGROUND TANKS STORING WASTE OIL

Tanks are considered to be underground when any portion is below ground or if the bottom is resting on the ground. Underground tanks are categorized as **existing** or **new**. Existing tanks are those installed before October 15, 1983 and new tanks are those installed on or after October 15, 1983.

General Operating Requirements For All Underground Waste Oil Tanks
(310 CMR 30.695 - 30.696)

The owner of the underground tank or an authorized representative must:

- o Prevent overfilling of tank by using appropriate controls and practices such as:
  - * Install a by-pass system to a standby tank
  - * Install a waste feed cut-off system
- o Check the tank at least once a day to ensure that it is in good working order.
  - * Inspect controls that prevent overfilling
  - * Gather data from temperature and pressure gauges or other monitoring equipment
- o Check the area around the tank at least once a week for obvious signs of leakage.

Labeling Waste Oil Tanks [310 CMR 30.340 (1) (b)]

- o Each tank must be clearly marked and labeled throughout the period of accumulation with a sign that reads:
  - * Hazardous Waste
  - * Waste Oil
  - * Toxic
  - * The date on which accumulation began

Testing Requirements for Existing Underground Waste Oil Tanks
[310 CMR 30.235 (1) (h) and 30.340 (1) (a) 2.b]

Leak Detection Tests are required for tanks installed before October 15, 1983 if they do not have a secondary containment system or monitoring system.

BEST MANAGEMENT PRACTICES
Chemical Manufacture

Dip Stick Test

A dip stick test must be conducted every 30 days. The owner of the tank or designated employee measures the height of the waste oil in the tank with a dip stick, seals the tank for 24 hours and then measures the level of oil again. If the difference in the oil levels measured is greater than 1/2 an inch, the test results must be immediately called in to the local fire chief and the nearest DEQE regional office. Written notice of the test results must be sent to the DEQE within 7 days.

Every 12 months a dip stick test must be performed except the tank must be sealed for 48 hours between measurements.

Dip stick test results must be recorded in a log, dated and signed by the tank owner or designated representative. All test records must be kept for at least 3 years, or for the duration of any enforcement action, or as requested by DEQE, whichever is longer.

Design Standards for New Underground Waste Oil Tanks
[310 CMR 30.253 (1) (g) and 30.340 (1) (a) 2.b]

Underground storage tanks installed after October 15, 1983 must meet one of two requirements.

1. The tank must be constructed of corrosion-resistant material such as fiberglass-reinforced plastic or externally coated or cathodically protected steel.

or

2. The tank must have a secondary containment structure and a monitoring system to detect leaks between the tank and the secondary containment structure and to detect water inflow.

In addition, the tank must be equipped with a striker plate to protect the tank bottom from wear or puncture during the dip stick test. There must also be a manhole large enough for a person to enter and inspect the tank.

BEST MANAGEMENT PRACTICES
Chemical Manufacture[3]

Storage Tanks and Containers

Structural design management practices

- Use careful selection of materials and design in construction of storage tanks. Tank manufacturers, dealers and suppliers should be consulted for compatibility with chemicals and ambient environment.

- Use secure weldings for steel tanks. Double-welded, butt joints are stronger than lap welded joints and less susceptible to crevice corrosion at the head and shell seams.

- Flammable liquids stored indoors in metal tanks should be grounded to avoid fire hazards. use of a bonding strip and ground clamps is a common method. (Contact local fire departments for information and assistance).

- Provide different containers to segregate different types of materials and waste. Keep storage containers in a separate area away from the active work area.

- Paint lines on the floor and post signs indicating "Hazardous Materials Storage Area."

- For outdoor storage, replace bungs on the tops of drums to prevent the entry of rainwater, and to prevent spills if the drums are tipped over. Cover drums with a plastic cover to reduce rusting and weathering.

- Hazardous substances should be stored on paved, impervious surfaces. An overcoating of epoxy on the surface may be needed for certain acids or caustics.

- Outdoor storage areas constructed with berms or dikes should have a permanent covering or roof to prevent stormwater from accumulating in the containment area and mixing with any leaked substances.

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[3] these Best Management Practices were adapted from: New York State Department of Environmental Conservation, September 1984, Spokane County Engineers Office, Water Quality Management Program Coordination Office, July 1986, and the Waste Systems Institute of Michigan, Inc., May 1986. Please refer to the bibliography for the complete reference.

BEST MANAGEMENT PRACTICES
Chemical Manufacture

Housekeeping

- Labels placed on containers stored outdoors should be resistant to unfavorable weather conditions.

- Maintain an accurate log or inventory of materials stored on site and investigate any changes in volume that may be due to leaks or spills.

Spill Containment and Overflow Prevention

Structural design management practices

- Loading docks and areas should be covered to prevent stormwater from mixing with any spilled chemicals or materials.

- Uncovered loading docks should be designed with a spill sump to catch and store any chemicals spilled, and provide for the release of stormwater through manual operation.

- Indoor storage or work areas with earth or gravel floors should have a subfloor synthetic containment liner to prevent infiltration of chemicals through soils. Liner material must be resistant to chemicals being stored.

- Nozzles used for filling tanks should be equipped with automatic shutoff valves.

- Designs should provide for the diversion of tank overflows to an adjacent tank.

- Tanks should be equipped with visual gauges to monitor fluid levels.

Housekeeping

- Operators should design a model **Spill Prevention Control and Cleanup Plan** in the event of a spill. The plan could include notification procedures, site plan illustrating direction of stormwater flow, physical description of potential spill sources and materials involved, description of operational procedures and employee training program.

- Absorbant materials such as kitty litter, sawdust, soil or clay should be kept on hand for emergency cleanups and containment in the event of a spill. Some spill cleanup kits are available with adsorption capabilities to reduce toxicity of the hazardous material while absorbing the spilled substance.

BEST MANAGEMENT PRACTICES
Chemical Manufacture

- Facilities designed with indoor fire sprinkler systems should consider the effect of the sprinkler system on the spill containment system. The containment system should be designed to hold a reasonable amount of fire suppression water.

- Use drip pans under spigots of chemical and oil containers to catch spills which occur while transferring liquids to other containers. Drip pans should be routinely emptied into hazardous waste containers for recycling, reuse or proper disposal.

- An operator should be on-site continually to monitor the filling of tanks and drums.

- Avoid transferring substances in areas that are not equipped with proper curbing, paving and spill catchment facilities.

- Regular inspections and maintenance should be conducted on spill prevention equipment.

Transfer Facilites

Structural design management practices

- Use careful selection of materils for piping, as with tanks.

- Breakage of underground pipes or loosening of pipe fittings can be minimized if swing joints are installed to allow for thermal expansion and differential settlement.

- Emergency shut-off valves should be strategically placed and designed to close automatically when a pipeline rupture occurs.

- Design spill overflow catchment sumps to catch overflows which occur when filling underground storage tanks from above ground tanks. This system should only be used where the area surrounding the inlet pipe is paved.

- Design in-ground protection channels for transfer hoses, to allow vehicular traffic to pass over without damaging the hose and to catch any leaks from faulty hose or connections.

Housekeeping

- Avoid overfilling containers, especially if stored indoors. Fifty-five gallons of some hazardous materials can expand to 60 or more when exposed to the heat of the sun, and will then overflow.

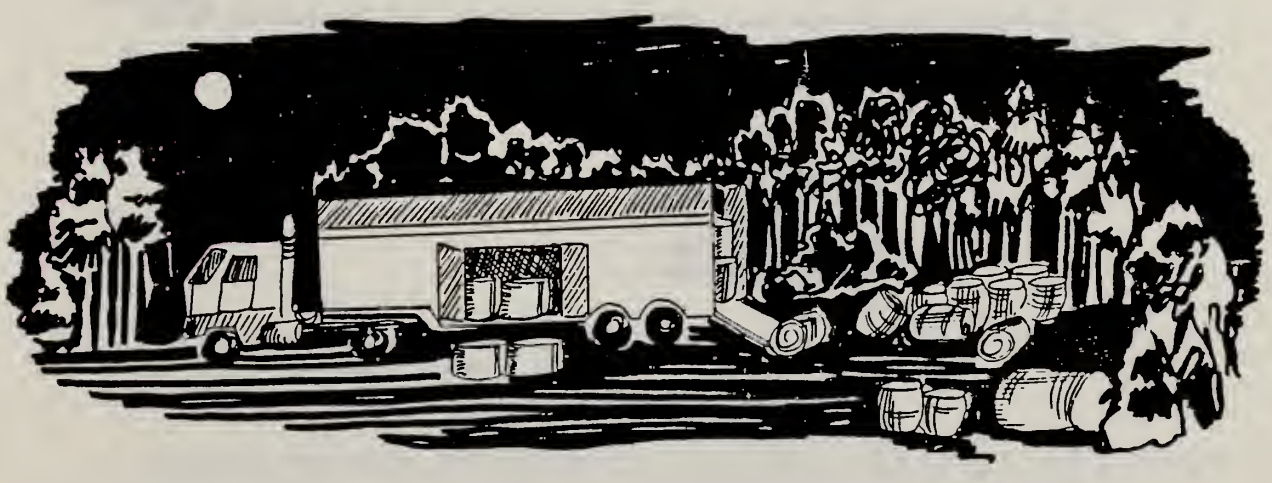
BEST MANAGEMENT PRACTICES
Chemical Manufacture

- Piping installations must have all lines properly identified with tags, plates, or painted colors.

- Operators should know the function of every line and the location of critical valves in order to operate them properly and shut the system off in case of an emergency.

Clandestine Dumping Areas

The clandestine dumping of household, commercial and industrial wastes generally occurs along utility rights-of-way, in abandoned sand and gravel pits or in areas made accessible by roads. The disposal of wastes in this manner can be a serious threat to groundwater quality due to the wide range of liquid and solid wastes that can be dumped. Liquid wastes may be poured onto the ground or left in unlabelled drums. Although the types of wastes disposed are extremely varied and not easily categorized, some examples include demolition debris, household hazardous wastes or wastes not accepted by municipal landfills, i.e., junk appliances, tires, used motor oil and antifreeze, septage, spent solvents, phenols and low-level radioactive wastes from commercial or industrial processing.



SOURCE: Maine Association of Conservation Commissions, 1983.

BEST MANAGEMENT PRACTICES
Clandestine Dumping Areas

- The Board of Health or designated local board/official should monitor and inspect areas where dumping is likely to occur including:
  - abandoned sand and gravel pits
  - utility rights-of-way
  - remote areas that have been made accessible by dirt roads or access rights-of-way
  - unmonitored and/or easily accessible junkyards, stump dumps and other disposal areas
- A list of potential dumping areas should be compiled and periodically updated using information gathered during a windshield survey, an inspection of aerial photographs and U.S.G.S. topographic maps, and interviews with local residents.
- If wastes are discovered, the DEQE Division of Hazardous Waste should be contacted immediately. The DEQE will aid the town in determining the proper containment and cleanup techniques.

Dry Cleaning [4]

Dry cleaning businesses use solvents as degreasers and cleaning agents to launder clothing and other articles. Improper storage of barrels and tanks containing solvents may result in accidental spills or leaks. Lint filters, lint and sludge saturated with solvents are also a threat to groundwater quality when carelessly discarded.

Most dry cleaning businesses store their solvents in 55-gallon drums or in storage tanks. The drums and tanks may be kept either inside or outside the building. One of the most commonly used solvents is tetrachloroethylene, also known as perchloroethylene. Other solvents which may be used are trichloroethane, trichloroethylene and methylene chloride.

The cleaning machines are large rotary washers that use solvents rather than soap and water. In most cases, the solvent is filtered through a cartridge and recycled. Used solvent can be purified on site through distillation if the dry cleaning facility has the proper equipment.



SOURCE: U.S. Environmental Protection Agency, Office of Solid Waste November 1986.

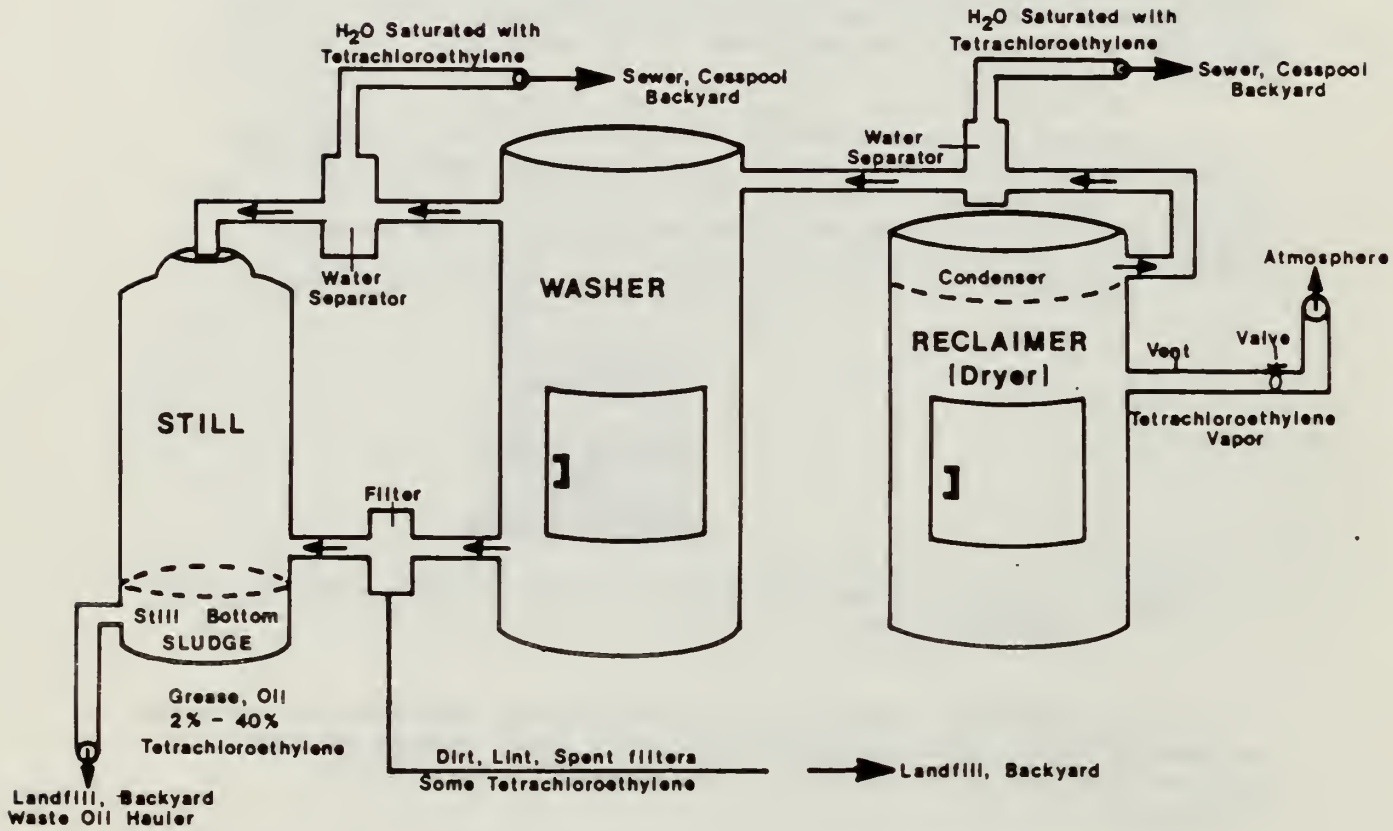
Cleaning machines, dryers and the distillation equipment are connected to exhaust vents. The condensate from these vapor exhaust systems contains some amount of solvent and is a potential groundwater contaminant.

Cleaning machines have gravity separating devices that allow any water in the solvent to rise to the top where it can be skimmed off into another container. Some units boil off this liquid. The quantity of this water is small (less than one gallon per month). However, this water is contaminated with solvents and must be disposed of properly. If not discarded, this water/solvent mixture may be used as a pre-spotter on heavily soiled garments.

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[4] Information describing the operational processes, procedures and BMPs for this business was obtained from: Connecticut Department of Environmental Protection, "Protecting Connecticut's Groundwater: A Guide to Groundwater Protection for Local Officials." 1984.

Typical drycleaning process illustrating points where tetrachloroethylene exits the system.



SOURCE: Center for Environmental Research, Water Resources Program, Cornell University, January 1987.

BEST MANAGEMENT PRACTICES
Dry Cleaners

- Outdoor storage facilities for tanks and drums should have a permanent roof to reduce sunlight on tanks and prevent precipitation from entering dikes.
- Indoor storage areas for drums and tanks should be located away from floor drains.
- Floor drains should be connected to holding tanks, not a septic system or sanitary sewer.
- Wastes collected in holding tanks should be disposed of through a licensed hazardous waste transporter.
- Lint filters, lint, sludge, exhaust condensate and waste solvents should be disposed of through a licensed hauler.
- Exhaust vents should be equipped to capture any dripping liquid.

HAZARDOUS WASTE ACCUMULATION AREA STANDARDS
(310 CMR 30.351 [8])

- Above-ground tanks and containers must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.
- Accumulation area must be secured against unauthorized entry.
- Accumulation area must be clearly marked (e.g., by a visible line or tape, or by a fence) and be separate from any points of generation.
- Accumulation area must be posted with a sign: "HAZARDOUS WASTE" in capital letters a least one inch high.
- An **outdoor** accumulation area must have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

  10% of the total volume of the containers, or
  110% of the volume of the largest container, whichever is larger.

BEST MANAGEMENT PRACTICES
Dry Cleaners

STANDARDS FOR CONTAINERS AND TANKS
(310 CMR 30.680, 30.690)

- Each container and tank must be clearly and visibly labeled throughout the period of accumulation with the following:
  - the words "HAZARDOUS WASTE"
  - the name of the waste (e.g., waste oil, acetone)
  - the type of hazard(s) (e.g., ignitable, toxic)
  - date on which accumulation began
- Each container must be in good condition.
- Wastes of different types must be segregated.
- Incompatible wastes must be separated by a berm, dike or similar structure.
- Each container holding hazardous wastes must be tightly closed throughout the period of accumulation, except when the waste is being added or removed.
- Accumulation areas must be inspected at least once a week for signs of leaks or spills. The aisle space between containers must be adequate to allow for inspections.

Furniture Stripping and Refinishing [5]

Furniture stripping operations generate solid wastes and wastewaters that have a wide range of pH's and contain high concentrations of metals and solvents. These solid and liquid wastes are potential groundwater contaminants and, if the untreated wastewater is discharged into a septic system, it may also be toxic to septic system bacteria.

Generally, furniture strippers use either a two-step or five-step process to remove paint, varnish, lacquer or wax from wood and metal pieces. The principal solvent in most stripping solutions is methylene chloride (dichloromethane) dissolved in a mixture of methanol or isopropyl alcohol and water. Smaller quantities of solvents such as acetone, perchloroethylene and toluene may also be present in the stripping solution. The methylene chloride stripping solution is a cold tank solution with a moderately to highly alkaline pH. Most shops conserve and recycle their stripping solution. However, the solution that adheres to the work piece is carried into rinsing tanks and contaminates the water with solvents, alcohols and metals. The spent rinse water is a potential groundwater contaminant and must be disposed of properly.

In the two-step process, the piece of metal or wood is soaked in a tank containing the methylene chloride stripping solution. After the work piece has soaked for a predetermined amount of time, it is removed and the loosened paint, varnish, lacquer and/or wax is scraped, wiped or brushed off. Wastes produced by this process are paint solids and rags soaked with solvent and paint residue. Some operations use a pressure hose or dip the piece in a still-rinse tank to remove loosened paint. These two practices generate wastewater contaminated with solvents, alcohols and heavy metals from paint residue.

Another common stripping solution is one that contains sodium hydroxide (lye) or potassium hydroxide (caustic potash) as its main constituent. This solution is highly alkaline (pH of 12.0 or higher) and is normally kept heated to a temperature between 90-120 degrees Fahrenheit. These stripping solutions also contain high concentrations of sodium carbonate and trisodium phosphate as well as smaller concentrations of surfactants and petroleum naptha.

Larger shops that handle a greater quantity of work normally use the five-step stripping process which consists of three solution tanks and two rinsing procedures. The piece of wood or metal is first soaked in a stripping tank that usually contains the methylene chloride solution previously described. Next, the work piece is removed from the stripping solution and dipped into a hot or cold caustic tank to remove the loosened paint, lacquer, varnish or wax. After the piece is removed from the caustic tank, it is rinsed with water from a pressure hose or immersed in a still-water tank.

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[5] Information describing the operational processes, procedures, and BMPs for this business was obtained from: Connecticut Department of Environmental Protection, "Protecting Connecticut's Groundwater: A Guide to Groundwater Protection for Local Officials." 1984.

The final solution tank contains phosphoric or muriatic acid (hydrochloric acid) which "neutralizes" the work piece and may also lighten or bleach some wood pieces. After the acid dip, the work piece is rinsed with water.

Groundwater contamination due to furniture stripping operations can result from the improper storage and disposal of rinsewaters and dipping solutions. Methylene chloride stripping solutions are usually recycled. However, the caustic and acid baths become weak and must be discarded. These highly alkaline or acid wastes contain various concentrations of methylene chloride and other solvents as well as metals. Rinsewaters usually contain very high concentrations of methylene chloride along with alcohols, metals and other solvents. The two most common metals found in rinsewaters contaminated by paint residue are lead and zinc. Other metals may be present in these rinsewaters, including titanium (present in newer paints), chromium, aluminium, copper and iron.

Businesses whose operations include the painting, staining and/or finishing of wood may use many products and generate waste that contain potential groundwater contaminants. The improper storage and disposal of new materials and wastes can result in the release of these contaminants to the groundwater. Typical ingredients in enamel, lacquer and acrylic paints include toluene, pigments, halogenated hydrocarbons, aromatic hydrocarbons and glycol ether. Wastes produced during the painting process generally are solvent solvents and paint wastes that contain high concentrations of heavy metals.

Stains usually contain mineral spirits, pigments and alcohol. Varnish, shellac and polyurethane are common finishes used by these businesses. They contain denatured alcohols, resins, petroleum distillates and toluene diisocyanate. Generally, wastes from staining and finishing processes are spent solvents and solvent sludges.

Furniture refinishing shops use solvents to clean their brushes and spray guns. These paint thinners, enamel reducers, varnish and shellac removers contain ingredients such as acetone, toluene, petroleum distillates, methanol and methylene chloride. Spent solvents and paint residues from these cleaning processes can contaminate groundwater and must be disposed of properly.

BEST MANAGEMENT PRACTICES
Furniture Strippers/Refinishers

- Untreated rinsewaters should not be discharged to a sanitary sewer, septic system, storm drain or surface water.

- Spent acid and alkaline solutions should be stored in a secure holding tank and disposed of through a licensed waste hauler.

- Paint sludges should be stored in covered containers.

- Stripping sludges must be stored in covered containers and disposed of through a licensed hazardous waste transporter.

- Cleaning rags contaminated with paint, lacquers, solvent or sludge should be recycled through a rag rental/cleaning service.

- Rinsewaters are classified as "wastewater" or hazardous waste. Because the concentration of solvents, alcohol and metals in rinsewater varies, the generator must have a laboratory test the rinsewater and determine its classification.

- Discharges of rinsewaters classified as "wastewater" to a septic system are regulated by the DEQE's Division of Water Pollution Control. Discharges to a sewer system are regulated by the local sewer authority.

- Rinsewaters classified as hazardous waste must be collected, stored and shipped through a licensed hazardous waste transporter.

- Spent acid and caustic baths that contain methylene chloride and other solvents, and metals must be disposed of through a licensed hazardous waste transporter.

- Stripping Solutions:

According the the Connecticut Department of Environmental Protection (1984), many of the shops in their state have no discharge at all due to the mode of operation or chemical vendor.

For example, Union Chemical Company of Union, Maine supplies a stripping solution that contains dimethylforamide and xylene rather than methylene chloride. Shops that use this solution dip the work pieces in tanks or spray the work pieces inside an enclosure. Any drippage is recirculated back through a rough screen or carbon absorption process. Another shop that uses a similar stripper made by DuPont, wipes or brushes the work piece over the solution tank; no water is used. All drippage goes into the solution tank. Sludge is the only waste generated.

BEST MANAGEMENT PRACTICES
Furniture Strippers/Refinishers

HAZARDOUS WASTE ACCUMULATION AREA STANDARDS
(310 CMR 30.351 [8])

- Above-ground tanks and containers must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.

- Accumulation area must be secured against unauthorized entry.

- Accumulation area must be clearly marked (e.g., by a visible line or tape, or by a fence) and be separate from any points of generation.

- Accumulation area must be posted with a sign: "HAZARDOUS WASTE" in capital letters a least one inch high.

- An outdoor accumulation area must have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

  10% of the total volume of the containers, or
  110% of the volume of the largest container, whichever is larger.

STANDARDS FOR CONTAINERS AND TANKS
(310 CMR 30.680, 30.690)

- Each container and tank must be clearly and visibly labeled throughout the period of accumulation with the following:

  - the words "HAZARDOUS WASTE"
  - the name of the waste (e.g., waste oil, acetone)
  - the type of hazard(s) (e.g., ignitable, toxic)
  - date on which accumulation began

- Each container must be in good condition.

- Wastes of different types must be segregated.

- Incompatible wastes must be separated by a berm, dike or similar structure.

- Each container holding hazardous wastes must be tightly closed throughout the period of accumulation, except when the waste is being added or removed.

- Accumulation areas must be inspected at least once a week for signs of leaks or spills. The aisle space between containers must be adequate to allow for inspections.

Hazardous Materials Storage and Transfer

The storage and transfer of hazardous materials can be a serious threat to groundwater quality. For example, accidents that occur during the transport of materials can result in the release of significant quantities of petroleum products, pesticides, solvents or radioactive wastes from damaged drums and tanks. If spills and leaks occur at transfer stations and are not immediately contained and cleaned up, contaminants enter the soil and may migrate to the groundwater. Storage areas for hazardous materials should have an impermeable floor, berms to contain spills, a leachate collection system and a roof.

BEST MANAGEMENT PRACTICES
Hazardous Materials Storage and Transfer[6]

Storage Tanks and Containers

Structural design management practices

- Use careful selection of materials and design in construction of storage tanks. Tank manufacturers, dealers and suppliers should be consulted for compatibility with chemicals and ambient environment.

- Use secure weldings for steel tanks. Double-welded, butt joints are stronger than lap welded joints and less susceptible to crevice corrosion at the head and shell seams.

- Flammable liquids stored indoors in metal tanks should be grounded to avoid fire hazards. use of a bonding strip and ground clamps is a common method. (Contact local fire departments for information and assistance).

- Provide different containers to segregate different types of materials and waste. Keep storage containers in a separate area away from the active work area.

- Paint lines on the floor and post signs indicating Hazardous Materials Storage Area.

- For outdoor storage, replace bungs on the tops of drums to prevent the entry of rainwater, and to prevent spills if the drums are tipped over. Cover drums with a plastic cover to reduce rusting and weathering.

- Hazardous substances should be stored on paved, impervious surfaces. An overcoating of epoxy on the surface may be needed for certain acids or caustics.

- Outdoor storage areas constructed with berms or dikes should have a permanent covering or roof to prevent stormwater from accumulating in the containment area and mixing with any leaked substances.

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[6] these Best Management Practices were adapted from: New York State Department of Environmental Conservation, September 1984, Spokane County Engineers Office, Water Quality Management Program Coordination Office, July 1986, and the Waste Systems Institute of Michigan, Inc., May 1986. Please refer to the bibliography for the complete citation.

BEST MANAGEMENT PRACTICES
Hazardous Materials Storage and Transfer

Housekeeping

- Labels placed on containers stored outdoors should be resistant to unfavorable weather conditions.

- Maintain an accurate log or inventory of materials stored on site and investigate any changes in volume that may be due to leaks or spills.

Spill Containment and Overflow Prevention

Structural design management practices

- Loading docks and areas should be covered to prevent stormwater from mixing with any spilled chemicals or materials.

- Uncovered loading docks should be designed with a spill sump to catch and store any chemicals spilled, and provide for the release of stormwater through manual operation.

- Indoor storage or work areas with earth or gravel floors should have a subfloor synthetic containment liner to prevent infiltration of chemicals through soils. Liner material must be resistant to chemicals being stored.

- Nozzles used for filling tanks should be equipped with automatic shutoff valves.

- Designs should provide for the diversion of tank overflows to an adjacent tank.

- Tanks should be equipped with visual gauges to monitor fluid levels.

Housekeeping

- Operators should design a model **Spill Prevention Control and Cleanup Plan** in the event of a spill. The plan could include notification procedures, site plan illustrating direction of stormwater flow, physical description of potential spill sources and materials involved, description of operational procedures and employee training program.

- Absorbant materials such as kitty litter, sawdust, soil or clay should be kept on hand for emergency cleanups and containment in the event of a spill. Some spill cleanup kits are available with adsorption capabilities to reduce toxicity of the hazardous material while absorbing the spilled substance.

BEST MANAGEMENT PRACTICES
Hazardous Materials Storage and Transfer

- Facilities designed with indoor fire sprinkler systems should consider the effect of the sprinkler system on the spill containment system. The containment system should be designed to hold a reasonable amount of fire suppression water.

- Use drip pans under spigots of chemical and oil containers to catch spills which occur while transferring liquids to other containers. Drip pans should be routinely emptied into hazardous waste containers for recycling, reuse or proper disposal.

- An operator should be on-site continually to monitor the filling of tanks and drums.

- Avoid transferring substances in areas that are not equipped with proper curbing, paving and spill catchment facilities.

- Regular inspections and maintenance should be conducted on spill prevention equipment.

Transfer Facilites

Structural design management practices

- Use careful selection of materils for piping, as with tanks.

- Breakage of underground pipes or loosening of pipe fittings can be minimized if swing joints are installed to allow for thermal expansion and differential settlement.

- Emergency shut-off valves should be strategically placed and designed to close automatically when a pipeline rupture occurs.

- Design spill overflow catchment sumps to catch overflows which occur when filling underground storage tanks from above ground tanks. This system should only be used where the area surrounding the inlet pipe is paved.

- Design in-ground protection channels for transfer hoses, to allow vehicular traffic to pass over without damaging the hose and to catch any leaks from faulty hose or connections.

Housekeeping

- Avoid overfilling containers, especially if stored indoors. Fifty-five gallons of some hazardous materials can expand to 60 or more when exposed to the heat of the sun, and will then overflow.

BEST MANAGEMENT PRACTICES
Hazardous Materials Storage and Transfer

- Piping installations must have all lines properly identified with tags, plates, or painted colors.

- Operators should know the function of every line and the location of critical valves in order to operate them properly and shut the system off in case of an emergency.

High Technology Industries*

In general, the term "high technology" refers to industrial enterprises which utilize state-of-the-art technological innovation and development. Producers of electronic components and semiconductors, computers, optical and scientific instruments, and communications equipment are examples of industries in this land use category. Non-electronics industries such as those manufacturing engines and turbines, aircraft, plastics, drugs, and photographic equipment are also considered high tech industries. Despite common perceptions that these industries are "clean" compared to traditional industries and manufacturing "high tech," the electronics manufacturing sector, especially, utilizes and generates a variety of hazardous materials that may cause contamination if not used, maintained, and disposed of properly. Some of the more common chemicals and compounds used in the electronics industry include, but are not limited to:

Solvents	acetone	isopropanol
	n-butyl acetate	2-ethoxyethanol
	tetrachloroethylene	toluene
	1,1,1-trichloroethane	freons
	trichloroethylene	xylene
Acids	chromic acid	nitric acid
	hydrogen chloride	phosphoric acid
	hydrogen fluoride	sulfuric acid
Bases	ammonium hydroxide	
	potassium hydroxide	
	sodium hydroxide	
Metals	antimony	chromium
	arsenic	lead
	barium	manganese
	beryllium	nickel
	cadmium	silver
Other Manufacturing Materials	asbestos	specialty chemicals
	epoxy resins	(e.g., mixtures of
	plasticizers	2 or more chemicals
	curing agents (methyl ethyl ketone)	of different categories)

(The most common source of public well contamination in Massachusetts has been the release of organic solvents. Please refer to appropriate discussion in the section on **Contaminants** for further information.)

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* Information describing the operational processes and procedures for these industries was obtained from: Golden Empire Health Planning Center, "High Tech and Toxics - A Guide for Local Officials," 1985.

A primary component of the electronics industry is the semiconductor, or "chip," a tiny device containing complex circuitry which allows information to be stored, processed, and transmitted. Large amounts of a variety of chemicals are required for their manufacture. Semiconductors are constructed from wafers of silicon sliced into very thin, five inch disks. During wafer manufacture, wastewaters containing acids, metals, silicon particles, organic solvents, and various coolants are generated. In the procedure that follows, wafer fabrication, hundreds of identical chips are produced on each wafer utilizing a photolithographic etching process. The wafers are repeatedly exposed to acids, solvents, and toxic gases as microscopic circuit patterns are etched into them. Wastes produced in the fabrication process include wastewater, spent solvents, exhaust condensate from hazardous gases, and contaminated oils from vacuum pumps. Printed circuit board manufacturers and metal platers are two industries associated with the manufacture of electronics hardware. These industries tend to generate significant quantities of wastewater and waste sludges containing metals. Industrial solvents and acids are also used to clean or brighten printed circuit boards.

Threats to groundwater from the high tech industries include illegal hazardous waste disposal, leaking storage tanks and containers, accidental spills and contaminated wastewater discharges. Hazardous liquids and degrading solid wastes may seep into the ground from landfills, waste ponds, injection wells, septic systems and leaching fields contaminating soil and groundwater. Poor housekeeping and inappropriate storage of materials may result in undetected leaks or spills from storage areas and tanks. Discharges of chemical-laden wastewater into sewer systems can corrode sewer pipes and leak contaminants into water supplies.

BEST MANAGEMENT PRACTICES

* Facility should implement a source reduction program to minimize the amount of hazardous materials and wastes used and generated. Various techniques are commercially available in the electronics manufacturing industry. For example, alternatives to the photo etching process include plasma etching and laser etching, which reduce the production of waste acids and eliminate other waste intensive steps. Another alternative is product reformulation, in which a less hazardous chemical may be substituted in the manufacturing process.

* Facility should implement techniques to recycle and recover industrial wastes for reuse. This would reduce the volume of waste requiring storage, transport and disposal. Solvent extraction and distillation, less water-intensive rinsing, and electrolytic metal recovery are examples of available technology. Although semiconductor manufacturing often maintains stringent standards on the purity of solvents used, users of recycled solvents in other industries may be found through a commercial waste exchange program.

* All wastewater should be treated to remove contaminants before disposal into municipal sewers or surface waters. Available technologies include neutralization of acids and bases; carbon adsorption and stripping with steam, air, or an inert gas, to remove solvents; and ion exchange to remove metals. Local officials should keep in contact with local industries and state officials to ensure compliance with federal and state pre-treatment standards. Sewer systems should be checked for leaking sewage outflow from faulty pipes, which might release pollutants underground.

* Proper management and good housekeeping of hazardous materials storage areas should be clearly outlined in a plan including properly designed storage facilities, engineering safeguards to prevent chemical accidents, employee training, maintenance and testing, and emergency response plans to handle spills. Please refer to appropriate discussions in **Hazardous Materials Storage Transfer**.

* Monitoring wells should be installed and tested on a regular basis in order to evaluate the land uses impact on local groundwater quality. Septic system sludges and discharges should be analyzed periodically to determine whether any industrial chemicals are entering the sanitary disposal system and potentially the groundwater system.

* Please refer to "Industrial Materials Storage and Transfer" section of this manual for additional applicable Best Management Practices, which should also include: Standards for Hazardous Waste Accumulation Areas (310 CMR 30.351 [8]); Standards for Containers and Tanks (310 CMR 30.680, 30.690); Design Standards for New Underground Waste Oil Tanks (30.253 [1][g] and 30.340 [1][a] 2.b); Testing Requirements for Existing Underground Waste Oil Tanks (30.235 [1][h] and 30.340 [1][a] 2.b); Labeling for Waste Oil Tanks (30.340 [1][b]); and General Operating Requirements for All Underground Waste Oil Tanks (30.695-30.696).

Industrial Lagoons and Pits

Industries use lagoons and pits to store, treat and/or dispose of wastewater, sludge and solid waste. Industrial waste is a serious threat to groundwater quality when placed in unlined lagoons and pits located in permeable soils. The function of these lagoons and pits is to allow the wastewater and other liquids to evaporate or percolate down through the soil.

As the Matrix illustrates, industrial lagoons and pits may contain wastes with any or all of the 18 groundwater contaminants listed. These contaminants can enter the groundwater by direct seepage of fluids through the sides and bottom of unlined lagoons and pits. With the inflow of fluid waste and precipitation, the toxic constituents of solid wastes and sludges can leach out and seep through the unlined lagoons and pits and enter the groundwater.

BEST MANAGEMENT PRACTICES
Industrial Lagoons and Pits[7]

- Provisions of the Federal Hazardous and Solid Waste Amendments of 1984 (HSWA) require:
  - * ban the landfilling of bulk, noncontainerized liquids.
  - * ban injection of hazardous waste into or above any formation within 1/4 mile of an underground source of drinking water.
- Existing surface impoundments must be retrofitted to comply with the Minimum Technology Standards by November 1988, or stop receiving, storing, or treating hazardous wastes, and close the impoundment.
- New surface impoundments must comply with the Minimum Technology Standards as follows:
  - * impoundments must include a double liner.
  - * impoundments must include a leachate system.
  - * a leak detection system must be installed between the liners.

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[7] U.S. Environmental Protection Agency, Office of Solid Waste,"RCRA Orientation Manual," EPA/530-SW-86-001, January 1986.

Jewelry and Metal Plating

Jewelry and metal plating operations perform several different processes including machinery, grinding, buffing, polishing, lettering, enameling, cleaning, electroplating and painting.

Highly acidic or basic plating wastewaters from electroplating operations generally contain appreciable concentrations of heavy metals. Acid plating solutions usually contain copper, nickel, zinc and cadmium while basic plating solutions may contain zinc. Sludges contaminated with heavy metals are also a waste product from tank clean-out during the electroplating process. Detergents and degreasing solvents are used to clean machinery and processed metal. Most jewelry and metal plating businesses generate waste oil from cutting or lubricating procedures and cyanide wastes from chelating processes.

Waste Types

Spent Solvents

Benzene
Toluene
Xylene
1,1,1-Trichloroethane
Trichloroethylene

Acid/Base Solution Wastes

Hydrofluoric Acid	HF
Nitric Acid	HNO_2
Phosphoric Acid	H_3PO_4
Potassium Hydroxide	KOH
Sodium Hydroxide	NaOH
Sulfuric Acid	H_2SO_4

Heavy Metal Wastewater/Sludges

Copper
Cadmium
Nickel
Zinc

BEST MANAGEMENT PRACTICES
Jewelry and Metal Plating

HAZARDOUS WASTE ACCUMULATION AREA STANDARDS
(310 CMR 30.351 [8])

- Above-ground tanks and containers must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.
- Accumulation area must be secured against unauthorized entry.
- Accumulation area must be clearly marked (e.g., by a visible line or tape, or by a fence) and be separate from any points of generation.
- Accumulation area must be posted with a sign: "HAZARDOUS WASTE" in capital letters a least one inch high.
- An outdoor accumulation area must have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

  10% of the total volume of the containers, or
  110% of the volume of the largest container, whichever is larger.

STANDARDS FOR CONTAINERS AND TANKS
(310 CMR 30.680, 30.690)

- Each container and tank must be clearly and visibly labeled throughout the period of accumulation with the following:

  - the words "HAZARDOUS WASTE"
  - the name of the waste (e.g., waste oil, acetone)
  - the type of hazard(s) (e.g., ignitable, toxic)
  - date on which accumulation began

- Each container must be in good condition.
- Wastes of different types must be segregated.
- Incompatible wastes must be separated by a berm, dike or similar structure.
- Each container holding hazardous wastes must be tightly closed throughout the period of accumulation, except when the waste is being added or removed.
- Accumulation areas must be inspected at least once a week for signs of leaks or spills. The aisle space between containers must be adequate to allow for inspections.

BEST MANAGEMENT PRACTICES
Jewelry and Metal Plating

UNDERGROUND TANKS STORING WASTE OIL

Tanks are considered to be underground when any portion is below ground or if the bottom is resting on the ground. Underground tanks are categorized as existing or new. Existing tanks are those installed before October 15, 1983 and new tanks are those installed on or after October 15, 1983.

General Operating Requirements For All Underground Waste Oil Tanks
(310 CMR 30.695 - 30.696)

The owner of the underground tank or an authorized representative must:

- Prevent overfilling of tank by using appropriate controls and practices such as:
  - * Install a by-pass system to a standby tank
  - * Install a waste feed cut-off system
- Check the tank at least once a day to ensure that it is in good working order.
  - * Inspect controls that prevent overfilling
  - * Gather data from temperature and pressure gauges or other monitoring equipment
- Check the area around the tank at least once a week for obvious signs of leakage.

Labeling Waste Oil Tanks [310 CMR 30.340 (1) (b)]

- Each tank must be clearly marked and labeled throughout the period of accumulation with a sign that reads:
  - * Hazardous Waste
  - * Waste Oil
  - * Toxic
  - * The date on which accumulation began

Testing Requirements for Existing Underground Waste Oil Tanks
[310 CMR 30.235 (1) (h) and 30.340 (1) (a) 2.b]

Leak Detection Tests are required for tanks installed before October 15, 1983 if they do not have a secondary containment system or monitoring system.

Dip Stick Test

A dip stick test must be conducted every 30 days. The owner of the tank or designated employee measures the height of the waste oil in the tank with a dip stick, seals the tank for 24 hours and then measures the level of oil again. If the difference in the oil levels measured is greater than 1/2 an inch, the test results must be immediately called in to the local fire chief and the nearest DEQE regional office. Written notice of the test results must be sent to the DEQE within 7 days.

Every 12 months a dip stick test must be performed except the tank must be sealed for 48 hours between measurements.

Dip stick test results must be recorded in a log, dated and signed by the tank owner or designated representative. All test records must be kept for at least 3 years, or for the duration of any enforcement action, or as requested by DEQE, whichever is longer.

Design Standards for New Underground Waste Oil Tanks
[310 CMR 30.253 (1) (g) and 30.340 (1) (a) 2.b]

Underground storage tanks installed after October 15, 1983 must meet one of two requirements.

1. The tank must be constructed of corrosion-resistant material such as fiberglass-reinforced plastic or externally coated or cathodically protected steel.

or

2. The tank must have a secondary containment structure and a monitoring system to detect leaks between the tank and the secondary containment structure and to detect water inflow.

In addition, the tank must be equipped with a striker plate to protect the tank bottom from wear or puncture during the dip stick test. There must also be a manhole large enough for a person to enter and inspect the tank.

Junkyards

Junkyard businesses buy or accept discarded, wrecked and abandoned automobiles, trucks, buses and trailers. Generally, junk vehicles remain in the junkyard for a specified time period (6 months - 1 year) during which all useful parts are removed and offered for sale. Junk vehicles may also be sold intact. Vehicles that remain in the lot for a long period of time are usually crushed and sent to a scrap metal facility.

Some junkyard operators collect brake and transmission fluids, antifreeze, batteries, gasoline and motor oil from the junk vehicles. Waste fluids are generally stored on-site in 55 gallon drums or in tanks. Uncontaminated gasoline may be stored for use by junkyard forklifts and other machinery. Usable batteries are stored and offered for sale; unusable batteries are collected and stored. Storage areas for waste fluids are a potential threat to groundwater quality.

BEST MANAGEMENT PRACTICES
Junkyards

Waste Type	Management
Oil Diesel Fuel	Do not mix the waste with anything, e.g., kerosene or gasoline
Solvents (thinner or degreaser)	Store in tightly covered containers
Batteries	If the batteries are cracked and leaking acid, they are a hazardous waste and must be shipped with a manifest via a DEQE-licensed hazardous waste transporter. To avoid leakage, batteries should be stored on pallets, banded and protected from the elements and unauthorized handling. Batteries that remain intact are not a hazardous waste and can be transported as a hazardous material to a reclaimer. Reclaimers may not be willing to accept small numbers of batteries. It is recommended that Junkyards work with distributors that will accept dead batteries in exchange for new ones.
Oil Contaminated Soil	Must be handled as a hazardous waste.
Antifreeze	Although antifreeze is not listed as a hazardous waste, it can contaminate groundwater. Antifreeze should be shipped with the hazardous waste transporter as a "non-hazardous" waste or taken to a hazardous waste facility. Antifreeze may not be disposed of in a landfill or septic system.

- Wastes should be stored in 55 gallon drums or other leakproof containers. Drums and containers should be fitted with secure lids to prevent spills, leaks and the introduction of precipitation.

- Outdoor storage facilities should have a permanent roof to prevent precipitation and sunlight from entering the storage area.

- Rags contaminated with paint, solvents, grease or oil should be sent to a rag rental/recycling facility.

BEST MANAGEMENT PRACTICES
Junkyards

HAZARDOUS WASTE ACCUMULATION AREA STANDARDS
(310 CMR 30.351 [8])

- Above-ground tanks and containers must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.

- Accumulation area must be secured against unauthorized entry.

- Accumulation area must be clearly marked (e.g., by a visible line or tape, or by a fence) and be separate from any points of generation.

- Accumulation area must be posted with a sign: "HAZARDOUS WASTE" in capital letters a least one inch high.

- An outdoor accumulation area must have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

  10% of the total volume of the containers, or 110% of the volume of the largest container, whichever is larger.

STANDARDS FOR CONTAINERS AND TANKS
(310 CMR 30.680, 30.690)

- Each container and tank must be clearly and visibly labeled throughout the period of accumulation with the following:

  - the words "HAZARDOUS WASTE"
  - the name of the waste (e.g., waste oil, acetone)
  - the type of hazard(s) (e.g., ignitable, toxic)
  - date on which accumulation began

- Each container must be in good condition.

- Wastes of different types must be segregated.

- Incompatible wastes must be separated by a berm, dike or similar structure.

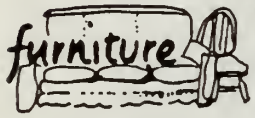
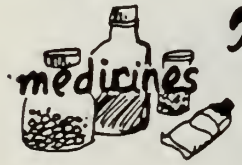
- Each container holding hazardous wastes must be tightly closed throughout the period of accumulation, except when the waste is being added or removed.

- Accumulation areas must be inspected at least once a week for signs of leaks or spills. The aisle space between containers must be adequate to allow for inspections.

Landfills

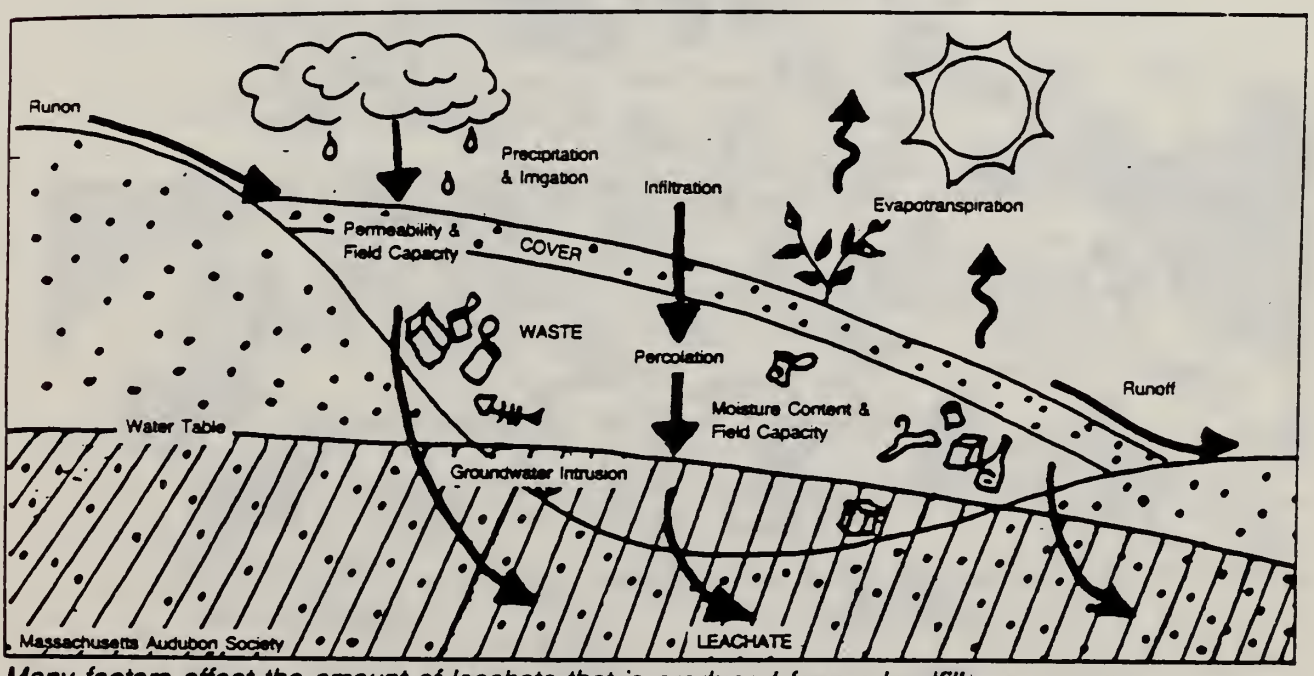
Municipalities and industries dispose of their wastes in sanitary landfills. According to the United States Environmental Protection Agency, landfills are among the five most serious threats to groundwater quality in the United States.

Groundwater contamination problems from landfills are quite common. As rain and melting snow infiltrate the landfill material and percolate down through the decomposing waste, contaminants are dissolved into water through the process of leaching. The resulting contaminated water, called leachate, moves downward through the landfill to the water table and migrates in the direction of groundwater flow. Landfill leachate is highly variable in its composition. Businesses, industries, institutions and households dispose of a wide range of toxic and hazardous wastes laden with organic and inorganic contaminants. Typical household hazardous wastes are toxic cleaning compounds, pesticides, fertilizers, paint, solvents and waste oil from do-it-yourself mechanics. Domestic hazardous wastes generally are produced in quantities too small to regulate. However, these quantities combined with the toxic wastes from businesses and industries result in highly contaminated leachate. Water supplies become contaminated when the leachate plume moves into the zone of contribution for a municipal well.

SOME PRODUCTS WE USE	SOME TYPICAL WASTES	HAZARDS
	solvents, waste organic compounds and sludges	toxic and flammable toxic
	cyanide from the printed circuits, metal sludges, chromic acids	toxic toxic toxic and corrosive
	waste organic compounds from dyes, solvents from synthetic fabrics	toxic toxic and flammable
	chromium shavings from the tanning process	toxic
	creosote, caustics from stripping, lead and pigments from paints	toxic toxic and corrosive toxic
	waste petroleum by-products, acid sludges from refining	toxic and flammable toxic and corrosive
	organic solvents and other residues, heavy metals like mercury and zinc	toxic and flammable toxic

SOURCE: Maine Association of Conservation Commissions, 1983.

The amount of infiltrating water and length of time it is in contact with landfill constituents are two factors controlling leachate formation. Frequently septage pits and lagoons are located at a landfill site which may increase the amount of water infiltrating the area. Another problem associated with landfills is groundwater mounding. Due to the lack of sufficient vegetation and impermeable areas on landfill surfaces, precipitation infiltrates the soil cover and refuse instead of flowing as surface runoff. The addition of this infiltrating water may result in a local mounding or rise in water table elevation under the landfill. If the water table intercepts or rises above the base of the landfill, the extended contact between the groundwater and the refuse may contaminate groundwater.



Many factors affect the amount of leachate that is produced from a landfill.

SOURCE: Massachusetts Audubon Society, Groundwater Information Flyer #8, July 1986.



Municipal Landfills Often Contain Small Amounts of Hazardous Waste From Households and Small Businesses.

SOURCE: U.S. Environmental Protection Agency, Office of Solid Waste, November 1986.

BEST MANAGEMENT PRACTICES[8]
Landfills

EDUCATE RESIDENTS

- Distribute flyers listing alternatives to household hazardous substances with tax bills, water bills and town reports.
- Sponsor public service announcements about source reduction on local cable TV stations or in local newspapers.
- Contribute news items about solid waste problems and solutions to local newspapers and radio stations.

CONTROL AMOUNTS AND KINDS OF WASTES DISPOSED IN THE LANDFILL

- Encourage recycling and composting.
- Evaluate wastes produced by town businesses and industries. Check up on waste disposal practices.
- Establish a waste oil repository at the landfill (Contact DEQE Division of Hazardous Waste for information about permits).
- Conduct regular household hazardous waste collection days (Contact Barbara Kelley, DEM Office of Safe Waste Management, 100 Cambridge St., Boston, MA 02202 or call (617) 727-3260).

OPERATION OF EXISTING TOWN LANDFILLS

- Train landfill operators about town procedures for waste disposal and the reasons for these procedures.
- Town officials should strictly enforce rules and regulations regarding waste disposal.
- Once a section of the landfill is filled, the landfill operator should promptly apply an impermeable cover.
- The landfill operator should properly grade the site to minimize infiltration of precipitation.
- Local officials should ensure that the landfill operator conscientiously monitors the disposal of wastes and prevents the disposal of hazardous materials.

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[8] adapted from the Massachusetts Audubon Society's, "Landfills and Groundwater Protection," Groundwater Information Flyer #8, Lincoln, MA. July 1986.

BEST MANAGEMENT PRACTICES
CLOSING EXISTING LANDFILLS AND SITING NEW LANDFILLS

Review and utilize the latest regulations for siting of new solid waste facilities and landfill closure issued by the DEQE Division of Solid Waste Management. Substantially revised siting criteria and accompanying regulations have recently been issued (please see Appendix A for 310 CMR 16.00, Site Assignment for Solid Waste Facilities, Emergency Regulations). Please contact the DEQE Division of Solid Waste for additional information After September 30, 1988, contact the State House Bookstore for copies of the final regulations.

Closing Existing Landfills -

- o Cap landfills with an impervious cover (clay and/or membrane) to reduce infiltration of precipitation
- o Install recovery system to capture leachate
- o Install groundwater monitoring wells

New Landfills -

- o Evaluate site location
  - proximity of surface waters and wetlands
  - geology of site
  - elevation of the water table
  - flow directions of surface and groundwater
  - location of existing public and private water supplies
  - location of potential water supplies and sole source aquifers
- o New landfills are prohibited within the Zone II area of public water supply wells. In the absence of a delineated Zone II, no new landfills will be sited within the Interim Wellhead Protection Area (IWPA) which is defined by a 0.5 mile radius around a public supply well or 15,000 ft. upgradient of the public supply well.
- o Investigate state-of-the-art landfill design and monitoring techniques
  - clay or membrane liner
  - leachate collection system
  - leachate treatment system
  - environmental monitoring
    - o groundwater
    - o leachate
    - o gas

- o Follow proper operating procedures
  - daily processing and compacting of waste
  - daily application of soil cover
  - prompt capping of completed sections
  - grading of landfill to minimize infiltration
  - improved monitoring of types of wastes brought to the landfill

Effectiveness

- o Leachate plumes may travel significant distances
- o No liner is 100% impervious

Laundromats

Neighborhood laundromats are equipped with washers, dryers and in some facilities, self-service dry cleaning machines. Patrons apply degreasing solvents to heavily stained or soiled clothing and add detergents, bleach, fabric softener and disinfectants to the water in the washing machines. Laundromats generate a significant quantity of wastewater contaminated with detergents, solvents and pathogens (viruses/bacteria). Other wastes include spent lint cartridges and cleaning solvents from the self-service dry cleaning machines.

Machine Shops and Metal Working [9]

Machine shops and metal working operations perform many different processes including turning, grinding, drilling, cutting, stamping, buffing and polishing to alter metal stock, usually steel, into a wide range of products such as wood screws, automobile parts and accessories, appliance parts, needles and pins.

During the metal grinding process, a recirculating water bath captures the grinding dust which settles out in a tank. Periodically, the water bath must be changed. The grinding sludges and waste water are potential groundwater contaminants and must be stored and disposed of properly.

Shavings and metal chips coated with oil from metal machining or stamping processes are usually disposed of in a dumpster or in drums. If these receptacles lack covers, precipitation collects and mixes with the oil. This liquid is a potential groundwater contaminant and may leak from drums or dumpsters or spill during pick-up and transport by the scrap dealer. Storage areas for waste oil and solvents also present a potential threat to groundwater quality.

Most machine shops use degreasing solvents for routine maintenance on machinery and for cleaning metal parts. Typical aromatic hydrocarbon solvents used in these operations are benzene, toluene and xylene while the common halogenated hydrocarbons used are trichloroethylene and 1,2-dichloroethylene. Please refer to section on Solvents for more detailed information.

Metal heat treating is a process by which a metal's tensile strength, density, electric resistivity, ductility and hardness can be changed. After heat treating, the parts are first dipped in tanks which may contain molten cyanide or non-cyanide salts and then they are immersed in a tank filled with quenching oil and/or an acid solution. The parts are rinsed in water and then dipped in oil for rust protection. Wastes generated by the metal heat treating process include waste oil and spent cyanide and acid solutions.

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[9] Information describing the operational processes, procedures, and BMPs for this business was obtained from: Connecticut Department of Environmental Protection, "Protecting Connecticut's Groundwater: A Guide to Groundwater Protection for Local Officials." 1984.

BEST MANAGEMENT PRACTICES
Machine Shops and Metal Working

- Drain plugs in dumpsters and drums containing oil coated scrap metal should remain in place. If oil/water liquid must be removed, it should be drained into a secure container and disposed of through a licensed waste hauler.

- Scrap metal should be recycled through a scrap metal dealer.

- In order to reduce solvent losses due to volatilization, tanks should always be covered when not in use.

- Spent solvents should be shipped to a licensed solvent recovery facility for recycling rather than disposing of the wastes through a hazardous waste disposal facility.

- Outdoor storage facilities for tanks/drums containing waste oil, spent solvent and sludges should have a permanent roof to prevent precipitation and sunlight from entering the storage area.

- Floor drains should be connected to a holding tank, not a septic system or sanitary sewer.

- Operators should use dry clean up methods rather than water flooding whenever possible.

- Drip trays and splash quards should be installed around the solution tanks.

- Wastes accumulated in holding tanks that are connected to floor drains must be disposed of through a licensed hazardous waste transporter.

- Operators should periodically inspect the tanks and tank liners that contain the acid or cyanide solutions.

- To reduce the carryover or "drag-out" of cyanide or acid solutions into the rinse waters:

    * Increase the drainage time of the work piece over the solution tank.
    * Blow the solution off the work piece with a low pressure air hose.
    * Use fog or spray rinsing over plating baths.

BEST MANAGEMENT PRACTICES
Machine Shops and Metal Working

HAZARDOUS WASTE ACCUMULATION AREA STANDARDS
(310 CMR 30.351 [8])

- Above-ground tanks and containers must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.

- Accumulation area must be secured against unauthorized entry.

- Accumulation area must be clearly marked (e.g., by a visible line or tape, or by a fence) and be separate from any points of generation.

- Accumulation area must be posted with a sign: "HAZARDOUS WASTE" in capital letters a least one inch high.

- An **outdoor** accumulation area must have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

  10% of the total volume of the containers, or
  110% of the volume of the largest container, whichever is larger.

STANDARDS FOR CONTAINERS AND TANKS
(310 CMR 30.680, 30.690)

- Each container and tank must be clearly and visibly labeled throughout the period of accumulation with the following:

  - the words "HAZARDOUS WASTE"
  - the name of the waste (e.g., waste oil, acetone)
  - the type of hazard(s) (e.g., ignitable, toxic)
  - date on which accumulation began

- Each container must be in good condition.

- Wastes of different types must be segregated.

- Incompatible wastes must be separated by a berm, dike or similar structure.

- Each container holding hazardous wastes must be tightly closed throughout the period of accumulation, except when the waste is being added or removed.

- Accumulation areas must be inspected at least once a week for signs of leaks or spills. The aisle space between containers must be adequate to allow for inspections.

BEST MANAGEMENT PRACTICES
Machine Shops and Metal Working

UNDERGROUND TANKS STORING WASTE OIL

Tanks are considered to be underground when any portion is below ground or if the bottom is resting on the ground. Underground tanks are categorized as **existing** or **new**. Existing tanks are those installed before October 15, 1983 and new tanks are those installed on or after October 15, 1983.

General Operating Requirements For All Underground Waste Oil Tanks
(310 CMR 30.695 - 30.696)

The owner of the underground tank or an authorized representative **must**:

- o Prevent overfilling of tank by using appropriate controls and practices such as:
  - * Install a by-pass system to a standby tank
  - * Install a waste feed cut-off system
- o Check the tank at least once a day to ensure that it is in good working order.
  - * Inspect controls that prevent overfilling
  - * Gather data from temperature and pressure gauges or other monitoring equipment
- o Check the area around the tank at least once a week for obvious signs of leakage.

Labeling Waste Oil Tanks [310 CMR 30.340 (1) (b)]

- o Each tank must be clearly marked and labeled throughout the period of accumulation with a sign that reads:
  - * Hazardous Waste
  - * Waste Oil
  - * Toxic
  - * The date on which accumulation began

Testing Requirements for Existing Underground Waste Oil Tanks
[310 CMR 30.235 (1) (h) and 30.340 (1) (a) 2.b]

Leak Detection Tests are required for tanks installed before October 15, 1983 if they do not have a secondary containment system or monitoring system.

Dip Stick Test

A dip stick test must be conducted every 30 days. The owner of the tank or designated employee measures the height of the waste oil in the tank with a dip stick, seals the tank for 24 hours and then measures the level of oil again. If the difference in the oil levels measured is greater than 1/2 an inch, the test results must be immediately called in to the local fire chief and the nearest DEQE regional office. Written notice of the test results must be sent to the DEQE within 7 days.

Every 12 months a dip stick test must be performed except the tank must be sealed for 48 hours between measurements.

Dip stick test results must be recorded in a log, dated and signed by the tank owner or designated representative. All test records must be kept for at least 3 years, or for the duration of any enforcement action, or as requested by DEQE, whichever is longer.

Design Standards for New Underground Waste Oil Tanks
[310 CMR 30.253 (1) (g) and 30.340 (1) (a) 2.b]

Underground storage tanks installed after October 15, 1983 must meet one of two requirements.

1. The tank must be constructed of corrosion-resistant material such as fiberglass-reinforced plastic or externally coated or cathodically protected steel.

or

2. The tank must have a secondary containment structure and a monitoring system to detect leaks between the tank and the secondary containment structure and to detect water inflow.

In addition, the tank must be equipped with a striker plate to protect the tank bottom from wear or puncture during the dip stick test. There must also be a manhole large enough for a person to enter and inspect the tank.

Municipal Wastewater/Sewer Lines

Typical municipal sewage contains grease, oil, sediments, scum, human excrement, pathogens (viruses/bacteria), sodium, chloride, pesticides, solvents, heavy metals, detergents and a wide variety of flotsam such as garbage and other urban refuse. This sewage travels through a system of sewer lines to a Publicly Owned Treatment System (POTW) where it undergoes primary or secondary treatment.

Primary Treatment

DEQE definition: removal of a minimum of 25% of the 5 day BOD (Biochemical Oxygen Demand - a standard measure of the organic material in a water sample that can be degraded in the presence of oxygen), 55% of the suspended solids and 85% of the floating and settleable solids.

In the primary treatment process, screens are used to collect and remove trash and large solids from the sewage. Sand, coffee grounds and other grit must be removed to prevent clogging and abrasion of the pipes and other moving parts in the treatment facility. The velocity of the wastewater flow is reduced and the grit settles out into large tanks and is removed. Floatable and settleable solids are removed in the primary sedimentation process. With the addition of chemicals, flocculant particles will aggregate and settle. In the settling basins, some of the oils, insoluble soaps, waxes and grease will float to the surface where they are removed while some of the material settles out with the sludge.

Secondary Treatment

DEQE definition: removal of a minimum of 85% of the 5-day BOD and suspended solids, all floating and settleable solids and disinfection.

Effluent from primary treatment normally contains a number of disease-causing microorganisms (pathogens), suspended solids, dissolved organic compounds, heavy metals, nitrates and phosphates. Secondary treatment of municipal wastewater involves the use of bacteria. There are various biological treatment systems including the trickling filter process, rotating biological reactors and the activated sludge process that rely upon microorganisms with the addition of oxygen to degrade organic material in the wastewater. In addition, the water is generally disinfected with chlorine.

Even after the secondary treatment processes, municipal wastewater contains various concentrations of volatile organic compounds (solvents), phenols, nitrates, phosphates and heavy metals. Secondarily treated wastewater can then be passed through a sand filter or discharged to rapid sand infiltration beds or leaching fields in a process refered to as "effluent polishing".

With respect to groundwater quality, treated wastewater that is discharged to rapid sand infiltration beds or leaching fields is of primary concern. Other disposal methods include discharge to surface water bodies and to the ocean.

Discharged effluent percolates down through the layers of sand, gravel and soil in the sand beds or leaching field. The main attenuation mechanism immobilizing the contaminants is sorption (please refer to section on Sorption). Phosphates and metals are sorbed onto soil particles and suspended solids are filtered out on the soil particles. However, volatile organic compounds, nitrates, phenols and the remaining metals are not attenuated by the sand and soil particles. Instead, they pass through the filter beds and leaching field relatively unaffected and may enter the groundwater.

Sewer Lines

Leaking sewer lines can be a serious threat to groundwater quality. Leaky sewer pipes may discharge raw sewage directly into the soils through which the they pass or into the groundwater that comes in contact with the pipes. Groundwater flowing into leaking sewer lines can overload the treatment plant, resulting in plant malfunction and the discharge of untreated wastewater to the leaching field or sand filter beds. Slugs of organic contaminants that enter sewer lines can travel to the wastewater treatment plant and render treatment systems inoperable by killing the bacteria that decompose the various components of wastewater.

Photographic Processing/Printers[10]

Commercial film developing and processing operations place the film on reels or handle it manually and run it through the various process baths and wash stations. The wash station baths run continuously and produce the major daily discharge of wastewater. Typically, this wastewater has a neutral to alkaline pH and contains various concentrations of acetate, formaldehyde, butyl alcohol and thiosulfate carried over from the process baths. The processing solutions, fixing baths, developers and stabilizers contain organic compounds that are biodegradable in a sewage treatment plant including:

Chemical	Source
2,4-dinitrophenol	developer dye
benzylalcohol	color developer
elon (p-methylaminophenol)	black and white developer
hydroquinone	black and white developer
thiosulfates and sulfites	fixing baths

However, several organic compounds - ethylene diamine, hexylene glycol and atrazinic acid - found in color developers are <u>not</u> biodegradable in a sewage treatment plant. The disposal of concentrated photo processing wastes and wastewater to a septic system may destroy the bacteria that breakdown the sewage.





SOURCE: U.S. Environmental Protection Agency, Office of Solid Waste November 1986.

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[10] Information describing the operational processes and procedures for this business was obtained from :Connecticut Department of Environmental Protection, "Protecting Connecticut's Groundwater: A Guide to Groundwater Protection for Local Officials." 1984.

The most common metal found in photographic processing wastes is silver. Film contains silver and when it is put in the fixing bath, the silver reacts with the thiosulfate to form silver thiosulfate. Due to the high market value of silver, most commercial operations use a chemical or electrolyte silver recovery system. A commonly used chemical recovery system consists of a small canister that contains steel wool. As the rinsewater from the fixer or the spent fixer is poured through this canister, the iron in the steel wool is replaced with silver in a simple ion exchange reaction. The iron is dissolved in the wastewater instead of the silver, giving it a reddish-brown tint. When the exchange capacity of the steel wool is exhausted, the canister is sent to a silver recovery business. Silver recovery systems may not be cost effective for residential darkrooms or small commercial operations. Silver thiosulfate that is discharged into a septic system will remain in the tank in its highly insoluble form - silver sulfide. When the tank is pumped, the silver sulfide is removed with the septage.

Printing Businesses

Printing businesses prepare text, illustrations and graphics and produce numerous types of publications including brochures, pamphlets, booklets, posters and stationery. For example, typesetting, lithography, letterpress, engraving and photoengraving are the processes used to prepare the material which is then printed by heatset and non-heatset lithography, business form printing, letterpress printing or screen press printing processes.

Wastes generated by printing operations include spent ink and ink sludges that may contain heavy metals and solvents. The composition of these inks can vary depending upon the process; i.e., lithography, letterpress, or screen printing. Oil-based or paste inks are normally composed of colorant or pigments, varnish, a drier that contains cobalt or manganese, extenders, solvents and modifiers. Fluid inks contain resins and solvents or oil and additives such as wetting agents, waxes and driers. Not all waste inks and ink sludges are potential groundwater contaminants; however, those that contain heavy metals and solvents are a threat to groundwater quality and should be handled and disposed of accordingly.

Both commercial photographic processing laboratories and printing businesses generate large quantities of spent developer and fixer. Printers also generate significant quantities of spent cleaning solvents which may contain 1,1,1-trichloroethane, trichloroethylene or ethyl benzene (see section on Solvents). These products are potential groundwater contaminants and should be stored in leakproof containers and disposed of through a licensed hazardous waste hauler. Oftentimes, rags or spray equipment are used to apply cleaning solvents to the printing presses, plates or screens. Rags are also used to wipe off excess ink from the presses.

BEST MANAGEMENT PRACTICES
Photo Processors/Printers

- Cleaning rags contaminated with ink and solvents should be recycled through a rag rental/cleaning service.

- Spent solvents and ink sludges should be stored in secure containers and disposed of through a licensed hazardous waste transporter.

- If economically feasible, spent fixer should be recycled to reclaim the silver.

Wastewater or spent fixer that contains more than 5 mg/l of silver is classified as a hazardous waste. Silver is a precious metal and can be reclaimed through various recycling devices.

- Very Small Quantity Generators (VSQG) generate less than 25 gallons of hazardous waste (including spent fixer) each month. VSQG may treat spent fixer and reclaim silver at the site of generation; no recycling permit is required.

- Small Quantity Generators (SQG) and Large Quantity Generators (LQG) generate more than 25 gallons of hazardous waste (including spent fixer) each month.

  *The SQG or LQG can use a recovery device directly connected by pipe to the film processor at the site of generations (no recycling permit required).

  *The SQG or LQG can use a recovery device that is free standing and not connected to the film processor (recycling permit required).

- All businesses that use recycling units must monitor the concentration of silver in their effluent.

- Spent fixer may not be discharged into a septic system without a groundwater discharge permit from the DEQE's Division of Water Pollution Control.

- Spent fixer must meet concentration limits of the local sewer authority before it can be discharged into a sewer system.

- If the silver recovery device does not produce effluent with an acceptable silver concentration (less than or equal to 5 mg/l), the effluent must be disposed of through a licensed hazardous waste transporter.

- When recycling is not an option, spent fixer and developer should be stored in secure containers and disposed of through a licensed hazardous waste transporter.

BEST MANAGEMENT PRACTICES
Photo Processors/Printers

HAZARDOUS WASTE ACCUMULATION AREA STANDARDS
(310 CMR 30.351 [8])

- Above-ground tanks and containers must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.

- Accumulation area must be secured against unauthorized entry.

- Accumulation area must be clearly marked (e.g., by a visible line or tape, or by a fence) and be separate from any points of generation.

- Accumulation area must be posted with a sign: "HAZARDOUS WASTE" in capital letters a least one inch high.

- An **outdoor** accumulation area must have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

  10% of the total volume of the containers, or
  110% of the volume of the largest container, whichever is larger.

STANDARDS FOR CONTAINERS AND TANKS
(310 CMR 30.680, 30.690)

- Each container and tank must be clearly and visibly labeled throughout the period of accumulation with the following:

  - the words "HAZARDOUS WASTE"
  - the name of the waste (e.g., waste oil, acetone)
  - the type of hazard(s) (e.g., ignitable, toxic)
  - date on which accumulation began

- Each container must be in good condition.

- Wastes of different types must be segregated.

- Incompatible wastes must be separated by a berm, dike or similar structure.

- Each container holding hazardous wastes must be tightly closed throughout the period of accumulation, except when the waste is being added or removed.

- Accumulation areas must be inspected at least once a week for signs of leaks or spills. The aisle space between containers must be adequate to allow for inspections.

Railroad Tracks and Yards/Maintenance Stations

Maintenance facilities for railroad cars provide a number of routine services and generate wastes that contain several different groundwater contaminants. Workers use degreasing solvents and strongly acidic or basic cleaning fluids to remove oil and grease from engine parts and to clean other freight car equipment. Strong acid and base solutions are also used to remove rust. Polychlorinated biphenyls (PCBs) have been used to flameproof diesel and electric locomotive transformer oil. Maintenance yards that provide painting services use thinners, primers, enamels, lacquers and other paints. Wastes generated during the painting process are contaminated with solvents and heavy metals such as lead, nickel and chromium.

Railroad maintenance facilities store new and used oil, solvents and fuel in underground storage tanks, 55 gallon drums or aboveground tanks. Underground tanks are a serious threat to groundwater quality if they are old, rusty or leaking (see section on Underground Storage Tanks).

Unsheltered outdoor storage facilities do not adequately protect tanks and drums from rain and other precipitation. With the addition of rainwater or snow, petroleum products, solvents in uncovered drums will overflow onto the ground. In addition, tanks, barrels and drums will rust when exposed to the elements; small pits and holes form allowing contaminants to spill onto the ground. Any spills that occur in storage facilities not equipped with an impervious floor (i.e., coated concrete) will infiltrate the soil and may reach the groundwater.

BEST MANAGEMENT PRACTICES
Railroad Tracks and Yards/Maintenance Stations

- Floor drains located in maintenance bays should be connected to a holding tank or sanitary sewer equipped with an oil and grit separating tank.
- Wastes collected in a holding tank must be diposed of through a licensed hazardous waste hauler.
- Large drip pans should be kept beneath the spigots of 55 gallon drums that are stored in a horizontal position on racks.
- Cleaning rags contaminated with paint, solvents oil or gasoline should be recycled through a rag rental/cleaning service.
- Outdoor storage facilities for drums and tanks should have a permanent roof to prevent precipitation and sunlight from entering the storage area.

BEST MANAGEMENT PRACTICES
Railroad Tracks and Yards/Maintenance Stations

HAZARDOUS WASTE ACCUMULATION AREA STANDARDS
(310 CMR 30.351 [8])

- Above-ground tanks and containers must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.
- Accumulation area must be secured against unauthorized entry.
- Accumulation area must be clearly marked (e.g., by a visible line or tape, or by a fence) and be separate from any points of generation.
- Accumulation area must be posted with a sign: "HAZARDOUS WASTE" in capital letters a least one inch high.
- An **outdoor** accumulation area must have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

  10% of the total volume of the containers, or
  110% of the volume of the largest container, whichever is larger.

STANDARDS FOR CONTAINERS AND TANKS
(310 CMR 30.680, 30.690)

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    - the name of the waste (e.g., waste oil, acetone)
    - the type of hazard(s) (e.g., ignitable, toxic)
    - date on which accumulation began

- Each container must be in good condition.
- Wastes of different types must be segregated.
- Incompatible wastes must be separated by a berm, dike or similar structure.
- Each container holding hazardous wastes must be tightly closed throughout the period of accumulation, except when the waste is being added or removed.
- Accumulation areas must be inspected at least once a week for signs of leaks or spills. The aisle space between containers must be adequate to allow for inspections.

Research Laboratories/Universities/Hospitals

The solid wastes and wastewaters generated by research laboratories and university laboratory facilities may vary depending upon the current research contract or particular project in progress. However, some typical wastes generated by these facilities might include radioactive wastes, spent solvents, acidic and basic solutions, tissues and cultures containing pathogenic viruses/bacteria and other wastes contaminated with phenols, nitrates and trace metals.

Hospitals generate wastes similar to those listed for the research and university labs. In addition, x-ray facilities located in the hospitals produce spent fixers and developers that contain silver and other trace metals as well as solvents. The solvent xylene is generally used in tissue preparation. Hospitals also use radioactive materials as tracers and dyes. In addition, disinfectants and other industrial detergents are used for cleaning and sterilization purposes. Proposed standards for medical waste are in the process of development.



SOURCE: U.S. Environmental Protection Agency, Office of Solid Waste, November 1986.

BEST MANAGEMENT PRACTICES
Research Labs/Universities/Hospitals

- See Massachusetts Standards for Satellite Accumulation (310 CMR 30.351(4)).

  It may be feasible for larger institutions to set up satellite accumulation areas, allowing the facility to accumulate up to 55 gallons of hazardous waste, or one quart of acutely hazardous waste, at each point where waste is generated. The following conditions must be met:

  * The waste must be generated from a process at the location of the satellite accumulation.

  * Each satellite accumulation area can have only one container for each waste stream in use at a time.

  * Each satellite accumulation area must be managed by the person who is directly responsible for the process producing the waste.

  * The waste must be removed to the main designated accumulation area within three days after the container is full.

- See the Code of Federal Regulations (CFR); 49 CFR, section 178, 118, Department of Transportation regulations for the packaging of hazardous wastes and substances; specifications on "lab packs."

- The facility should implement a hazardous waste minimization program to reduce risks of contamination related to storage and disposal. Strategies include:

  * substitution of non-hazardous materials.

  * redistribution of unused or surplus chemicals through a materials exchange program within the facility.

  * conducting micro-scale experiments.

- In-lab neutralization or chemical treatment may reduce the toxicity of wastes, allowing for disposal as a non-hazardous material (American Chemical Society, March 1983).

- Wastewater from laboratory operations, such as cleaning glassware, or excess samples not to be stored, may be discharged into a laboratory drain system that is separate from the sanitary wastewater drain system. The laboratory drains should feed into neutralization pits before discharging wastewater into sewer systems that lead to publicly-owned treatment works (POTWs) (Stalzer, April 1985).

BEST MANAGEMENT PRACTICES
Research Labs/Universities/Hospitals

- Avoid storing hazardous materials in glass containers which can easily break (Waste Systems Institute of Michigan, Inc., May 1986).

- Rinsewater should enter a laboratory drain system before being discharged to a sewer system.

Road and Maintenance Depots/Road Deicing

Municipal Departments of Public Works (DPW) and Highway Departments use petroleum products and degreasing solvents during routine maintenance procedures on dump trucks, road graders and other vehicles. These facilities store new and waste motor oil, antifreeze, brake fluid, hydraulic fluid and solvents in 55 gallon drum, aboveground or underground tanks. Most garages store gasoline and diesel fuel in underground storage tanks in order to provide on-site refueling of town vehicles. These tanks and the piping systems are a threat to groundwater quality if they are old, rusty or leaking (see section on Underground Storage Tanks).

Generally, vehicles are serviced in garage bays or outside in the lot (which may or may not be paved). Wastes generated during vehicle maintenance operations include used motor oil and filters from oil changes, old antifreeze, spent solvents from the cleaning/degreasing of parts, waste fuel and filters from fuel filter changes and used hydraulic and brake fluid. These wastes can contaminate groundwater if careless spills and accidental leaks are not immediately contained and cleaned up. For example, if a spill of new or waste product occurs on the paved lot, the contaminant may enter a nearby storm drain and infiltrate the soil through a leaching catch basin or it may enter the sewer system (see Stormwater Drains and Retention Basins section). On an unpaved lot, the contaminant would infiltrate the soil and migrate down to the groundwater.

Municipal Park Departments spray pesticides and herbicides on the trees, shrubbery and grass in public parks, gardens and forests to kill insects and weeds. DPWs may also use pesticides to control weed growth along roadways and municipal rights-of-way. Groundwater may become contaminated due to spills that occur when the pesticides are mixed and loaded into the application equipment. The improper disposal of leftover pesticides and containers is also a threat to groundwater quality.

Unsheltered outdoor storage facilities do not adequately protect tanks and drums from rain and other precipitation. With the addition of rainwater or snow, petroleum products, solvents and pesticides in uncovered drums will overflow onto the ground. In addition, tanks, barrels and drums will rust when exposed to the elements; small pits and holes form allowing the contaminants to spill onto the ground. Any spills that occur in storage facilities not equipped with an impervious floor (i.e., coated concrete) will infiltrate the soil and may reach the groundwater.

DPW and Highway Department trucks apply sand and sodium chloride (road salt) to deice roads during the winter months. Storage areas for road salt are a major threat to groundwater quality if the salt pile is not completely covered and resting on an impermeable surface. Sodium is very soluble in water and highly mobile (see Sodium and Chloride sections). With the addition of precipitation, salt from uncovered piles will leach into the soil and groundwater. Seven municipalities have closed their wells due to contamination by sodium chloride: Auburn, Braintree, Dedham/ Westwood, Reading, Scituate, Weston and Yarmouth (DEQE, 1986). In addition, due to road salt storage and application practices, approximately 47 communities have excessive sodium concentrations in their public supply wells (DEQE, 1985).

BEST MANAGEMENT PRACTICES
Road and Maintenance Depots

- Floor drains should be connected to a holding tank or sanitary sewer equipped with an oil and grit separating tank.
- Wastes collected in a holding tank must be disposed of through a licensed hazardous waste transporter.
- Large drip pans should be kept beneath the spigots of drums that are stored in a horizontal position on racks.
- Cleaning rags contaminated with paint, solvents, oil or gasoline should be recycled through a rag rental/cleaning service.
- Outdoor storage facilities for spent solvents, waste oil and other hazardous waste should have a permanent roof to prevent precipitation and sunlight from entering the storage area.

Waste Type	Management
Batteries	If the batteries are cracked and leaking acid, they are a hazardous waste and must be shipped with a manifest via a DEQE-licensed hazardous waste transporter. To avoid leakage, batteries should be stored on pallets, banded and protected from the elements and unauthorized handling. Batteries that remain intact are not a hazardous waste and can be transported as a hazardous material to a reclaimer. Reclaimers may not be willing to accept small numbers of batteries. It is recommended that businesses work with distributors that will accept dead batteries in exchange for new ones.
Oil Diesel Fuel	Do not mix the waste with anything, e.g., kerosene or gasoline
Solvents (thinner or degreaser)	Store in tightly covered containers
Gasoline	Store containers as full as possible to prevent vapors and the chance of explosion

BEST MANAGEMENT PRACTICES
Road and Maintenance Depots/Road Deicing

Salt Storage and Handling [11]

Salt storage and mixing facilities **should not be located within the Zone II (primary recharge areas) of public water supply wells.** Generally, these facilities should be located on flat sites and on impervious surfaces that are protected from overland runoff. Please refer to sections on Sodium and Chloride for additional information.

Cover Salt Piles

- Salt piles should be stored under cover to prevent losses due to precipitation and runoff.

  *Communities should build salt storage sheds to contain their salt piles. For interim protection, all salt storage piles should be placed on an impermeable pad and covered with a waterproof covering.

Provide for Drainage

- To protect groundwater quality, the storage area should have adequate drainage facilities to handle the buildup of salt brine in the storage shed. Brine buildup can be avoided by:

  *Proper design of the storage shed and impervious pad.

  *Covering and sloping the storage piles to provide for drainage.

  *Collecting any saline water that may develop in a tight drainage system. The collected brine can then be dried and reapplied to the stockpile during dry seasons or used during the salting season (apply the brine directly to the trucks).

Handling of Road Salt

- To reduce the waste of rald salt and ensure the easy handling and proper application:

  *Keep the chemicals dry through proper storage.
  *Keep the handling area unobstructed and clean of spilled chemicals.
  *Reduce unnecessary handling through proper planning of shipments.
  *Shield truck-loading and unloading operations from wind and weather.

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[11] adapted from the Department of Environmental Quality Engineering, "Road Salts and Water Supplies: Best Management Practices," Boston, MA. April 1985.

BEST MANAGEMENT PRACTICES
Road and Maintenance Depots

Snow Dumping

The dumping of snow plowed from highways, parking lots and areas which have been treated with salt has the potential to contaminate groundwater due to the mobility of sodium and chloride ions in the soil.

- Snow disposal sites should be carefully chosen. Snow should not be disposed of in the primary recharge area (Zone II) of public supply wells.
- Snow should not be disposed of at a sanitary landfill since the added moisture from the melting snow will contribute to leachate generation.
- Avoid direct dumping of snow into rivers or water sources. Consider downstream uses of the tiver and the impacts due to direct disposal into rivers.
- Try to choose a site near a large river with suitable soils where the melted snow can filter through the soil.

Road Salt Application

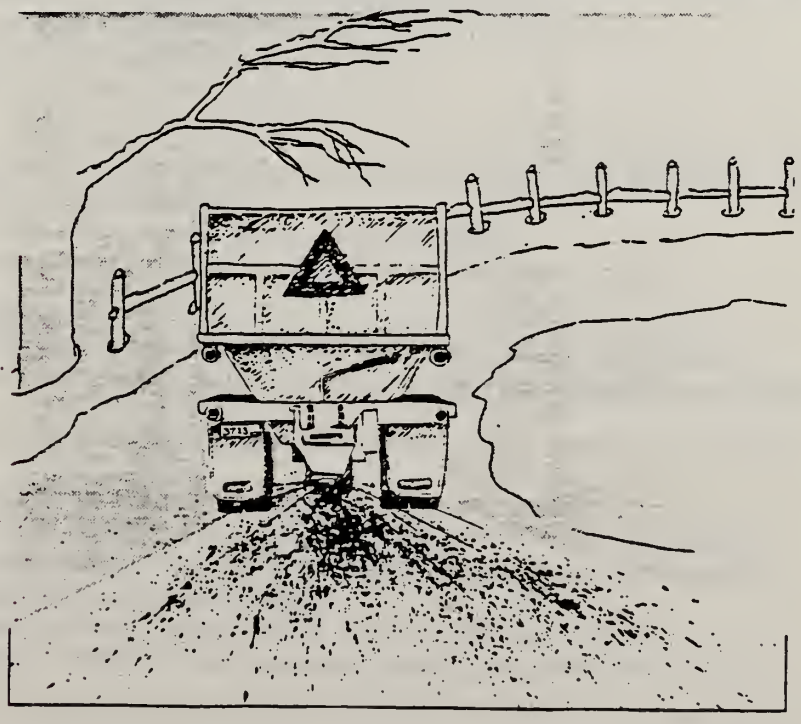
- Sensitive areas should be identified and made known to all road crews. Areas around public water supplies should be designated as sensitive areas where control over salt storage and application should be practiced.



SOURCE: Pioneer Valley Planning Commission, 1986.

BEST MANAGEMENT PRACTICES
Road and Maintenance Depots

- Ground-speed controllers should be used for all spreaders.
- Spreaders should be calibrated before the winter season, using the materials to be used (salt, mixtures of sand and salt, etc.)
- Levels of service depending on road type, weather conditions and traffic volumes should be determined prior to the winter season. These levels of service can range from no salt use, to mainly plowing and using sand, to straight salt application on heavily traveled road sections and critical intersections.
- Application rates should be determined for the service area. Reduced salting rates should be developed for "sensitive areas" (roads adjacent to surface and groundwater supplies).
- Various mixtures of salt, calcium chloride and sand should be used in identified sensitive areas. The State of Connecticut recommends that a 7:2 sand - premix should be used in sensitive areas. Premix is 3 parts sodium chloride and 1 part calcium chloride by weight.



SOURCE: Pioneer Valley Planning Commission, 1986.

BEST MANAGEMENT PRACTICES
Road and Maintenance Depots

- Maintain equipment to ensure that the necessary plows and spreading equipment are in proper order.

- Appropriate accounting should be conducted after the storm to determine the amount of materials used, the area covered, and the results. This could be done using a standardized reporting form.

- Towns should keep aware of new and approved techniques on the application of road salts

- Explore alternatives. Experiments should be conducted as new chemical alternatives are introduced. A new chemical which shows promise is calcium magnesium acetate (CMA). The U.S. Department of Transportation is currently conducting field tests of the use of CMA.

- Another alternative that is currently being field tested is an asphalt additive called Verglimit (American City and County, 1980). Verglimit is a multi-component defroster composed of partially crystallized calcium chloride (80 percent) and sodium hydroxide (5 percent) which is added to the top-course mix of the roadway. A thin layer of calcium chloride solution develops on the road surface and prevents ice formation.

SNOW AND ICE CONTROL CHECKLIST

SALT STORAGE AREAS	YES	NO
Are storage areas located far away from water supplies, wells, aquifers, lakes, ponds, wetlands, bogs, and other sensitive areas?	☐	☐
Are all salt piles stored in sheds?	☐	☐
If not, are storage areas covered and on impervious pads?	☐	☐
Are storage areas properly drained?	☐	☐
Can brine from drainage systems be dried for use on roads?	☐	☐
Is handling area unobstructed and clean of spilled chemicals?	☐	☐
Are truck loading and unloading operations shielded from wind and weather?	☐	☐
Are salt shipments planned so no extra handling or temporary outside storage is needed?	☐	☐
CHEMICAL APPLICATION		
Have sensitive areas (water supplies, aquifer recharge areas, etc.) been identified?	☐	☐
Are reduced salting rates or other special measures used to protect sensitive areas?	☐	☐
Are different levels of service used for different road types and weather conditions?	☐	☐
Is the no-salt alternative or sand/salt alternative used wherever possible?	☐	☐
Are individual maintenance crew members assigned the same section of road and the same equipment for each storm?	☐	☐
Is information on new techniques sought and used when appropriate?	☐	☐
EQUIPMENT AND MAINTENANCE		
Are ground-speed controllers used for all salt spreaders?	☐	☐
Are spreaders calibrated before the winter season begins, with actual tests of material to be used?	☐	☐
Are underbody scrapers used to scrape the road before applying chemicals?	☐	☐
Is preseason maintenance done before the winter begins?	☐	☐
Is equipment maintenance done immediately after each storm?	☐	☐
Are spare parts on hand before the season begins?	☐	☐
SNOW DUMPING		
Is snow that is removed from highways, parking lots, and other salt-treated areas disposed of in areas where water supplies will not be contaminated?	☐	☐
Is direct dumping into rivers, wetlands, lakes, ponds, and bogs avoided?	☐	☐
Is snow dumped away from sanitary landfills, to avoid leaching of wastes?	☐	☐
TRAINING AND PLANNING		
Are snow schools or other training sessions held to train snow removal equipment operators?	☐	☐
Do crew members know where sensitive areas are and how to treat them, especially on their individual sections of road?	☐	☐
Are crew members familiar with the DEQE overlay maps showing aquifers, roads, and salt-storage areas?	☐	☐
Are outside experts brought in to explain groundwater issues at snow schools?	☐	☐
Are crew members asked for suggestions on maintenance of the areas they are familiar with?	☐	☐
Do local conservation commissioners and board of health members help in the planning stage?	☐	☐
Are levels of service planned before the winter starts?	☐	☐
Do crew members understand the connection between salt levels and public health?	☐	☐
Is the public warned to drive carefully in areas that are not salted or are given minimal chemical treatment?	☐	☐

SOURCE: Massachusetts Audubon Society, Groundwater Information Flyer #9, February 1987.

BEST MANAGEMENT PRACTICES
Road and Maintenance Depots/Road Deicing

STANDARDS FOR HAZARDOUS WASTE ACCUMULATION AREAS
(310 CMR 30.351 [8])

- Above-ground tanks and containers must be on a surface which does not have any cracks or gaps and is impervious to the hazardous wastes being stored.
- Accumulation area must be secured against unauthorized entry.
- Accumulation area must be clearly marked (e.g., by a visible line or tape, or by a fence) and be separate from any points of generation.
- Accumulation area must be posted with a sign: "HAZARDOUS WASTE" in capital letters a least one inch high.
- An outdoor accumulation area must have secondary containment, such as a berm or dike, which will hold any spill or leaks at:

  10% of the total volume of the containers, or
  110% of the volume of the largest container, whichever is larger.

STANDARDS FOR CONTAINERS AND TANKS
(310 CMR 30.680, 30.690)

- Each container (i.e, a 55 gallon drum) and tank must be clearly and visibly labeled throughout the period of accumulation with the following:

  - the words "HAZARDOUS WASTE"
  - the name of the waste (e.g., waste oil, acetone)
  - the type of hazard(s) (e.g., ignitable, toxic)
  - date on which accumulation began

- Each container must be in good condition.
- Wastes of different types must be segregated.
- Incompatible wastes must be separated by a berm, dike or similar structure.
- Each container holding hazardous wastes must be tightly closed throughout the period of accumulation, except when the waste is being added or removed.
- Accumulation areas must be inspected at least once a week for signs of leaks or spills. The aisle space between containers must be adequate to allow for inspections.

BEST MANAGEMENT PRACTICES
Road and Maintenance Depots/Road Deicing

UNDERGROUND TANKS STORING WASTE OIL

Tanks are considered to be underground when any portion is below ground or if the bottom is resting on the ground. Underground tanks are categorized as **existing** or **new**. Existing tanks are those installed before October 15, 1983 and new tanks are those installed on or after October 15, 1983.

General Operating Requirements For All Underground Waste Oil Tanks
(310 CMR 30.695 - 30.696)

The owner of the underground tank or an authorized representative must:

- Prevent overfilling of tank by using appropriate controls and practices such as:
  - * Install a by-pass system to a standby tank
  - * Install a waste feed cut-off system
- Check the tank at least once a day to ensure that it is in good working order.
  - * Inspect controls that prevent overfilling
  - * Gather data from temperature and pressure gauges or other monitoring equipment
- Check the area around the tank at least once a week for obvious signs of leakage.

Labeling Waste Oil Tanks [310 CMR 30.340 (1) (b)]

- Each tank must be clearly marked and labeled throughout the period of accumulation with a sign that reads:
  - * Hazardous Waste
  - * Waste Oil
  - * Toxic
  - * The date on which accumulation began

Testing Requirements for Existing Underground Waste Oil Tanks
[310 CMR 30.235 (1) (h) and 30.340 (1) (a) 2.b]

Leak Detection Tests are required for tanks installed before October 15, 1983 if they do not have a secondary containment system or monitoring system.

BEST MANAGEMENT PRACTICES
Road and Maintenance Depots/Road Deicing

Dip Stick Test

A dip stick test must be conducted every 30 days. The owner of the tank or designated employee measures the height of the waste oil in the tank with a dip stick, seals the tank for 24 hours and then measures the level of oil again. If the difference in the oil levels measured is greater than 1/2 an inch, the test results must be immediately called in to the local fire chief and the nearest DEQE regional office. Written notice of the test results must be sent to the DEQE within 7 days.

Every 12 months a dip stick test must be performed except the tank must be sealed for 48 hours between measurements.

Dip stick test results must be recorded in a log, dated and signed by the tank owner or designated representative. All test records must be kept for at least 3 years, or for the duration of any enforcement action, or as requested by DEQE, whichever is longer.

Design Standards for New Underground Waste Oil Tanks
[310 CMR 30.253 (1) (g) and 30.340 (1) (a) 2.b]

Underground storage tanks installed after October 15, 1983 **must** meet one of two requirements.

1. The tank must be constructed of corrosion-resistant material such as fiberglass-reinforced plastic or externally coated or cathodically protected steel.

or

2. The tank must have a secondary containment structure and a monitoring system to detect leaks between the tank and the secondary containment structure and to detect water inflow.

In addition, the tank must be equipped with a striker plate to protect the tank bottom from wear or puncture during the dip stick test. There must also be a manhole large enough for a person to enter and inspect the tank.

Sand and Gravel Mining/Washing

The extraction of sand and gravel is the principal surface mining operation in Massachusetts. Generally, sand and gravel pits are located in permeable glacial outwash deposits that supply recharge to the groundwater system. The presence of water in these pits is usually a sign that they are hydraulically connected to the water table. In most cases, these pits lack a significant soil and vegetative cover which acts as both a buffer and a filter to incoming contaminants.

Due to the permeable nature of their deposits, location in aquifer recharge areas, proximity to the water table and lack of soil cover, sand and gravel pits make groundwater especially vulnerable to contamination. Furthermore, these pits can act as large conduits to the groundwater system.

The use and storage of diesel fuel, motor oil, hydraulic fluid and solvents in these sensitive areas can result in groundwater contamination if spills/leaks occur or if the spent products are disposed of improperly.

Sand and gravel mining operations use trucks, bulldozers, conveyer belts and sizing/sorting machinery to extract material for use as fill or in the mixing of concrete. Groundwater contamination may occur during routine machinery maintenance (oil and hydraulic fluid refills or changes) if performed in the sand and gravel pit. Degreasing solvents may also be used to clean parts and machinery. Oftentimes, bulldozers and trucks are refueled on-site. Many large mining operations maintain garages in order to provide on-site repair/refueling services. These garages may store large quantities of petroleum products and solvents.

Abandoned Pits

Another major threat to groundwater quality is from the unregulated dumping or disposal of wastes in abandoned excavation pits. A wide variety of materials have been found in abandoned pits including junk automobiles, tires, garbage, salt-laden snow, used motor oil and other liquid wastes. Potential groundwater contaminants are as varied as the wastes. Leachate from the wastes can easily percolate down through the remaining soil, sand and gravel layers into the groundwater system.

In April 1979, the town of Dartmouth's Police Department and DEQE personnel apprehended an individual dumping hazardous waste in a sand and gravel area 1300 feet from Dartmouth's Route 6 well (Special Legislative Commission on Water Supply, 1986). Subsequent investigations revealed nearly 1000 barrels of improperly and illegally stored hazardous waste at the site. Water sampled within the recharge area of the Route 6 well contained 4 parts per billion (ppb) chloroform and 1.5 ppb dichloroethylene. In response to this incident, Dartmouth adopted an aquifer protection overlay district bylaw in early 1981.

BEST MANAGEMENT PRACTICES
Sand and Gravel Mining/Washing[12]

- Mining activities should be located away from recharge areas of aquifers currently in use as, or protected for future use as, public water supplies.

- Ensure that access roads are properly constructed, maintained and closed so as to prevent or control erosion.

- Prohibit excavation within 50 feet of a watercourse and within 15 feet of the water table.

- Limit active gravel removal to a total of five acres at any one time to minimize the amount of surface area susceptible to erosion.

- Provide appropriate drainage systems to prevent ground and surface water contamination. Drainage should not lead directly into streams or ponds.

- All topsoil and subsoil should be stripped from the operation area and reserved for restoration of the area.

- Quickly stabilize disturbed areas by restoring overburden, replacing topsoil, avoiding steep slopes, reproducing natural drainage patterns, and replacing vegetation.

- Maintain an adequate vertical separation between the deepest depth of excavation and the maximum high water table elevation.

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[12] adapted from the Berkshire County Regional Planning Commission "208 Mine-Related Activities and Water Quality", 1979 Addendum to Water Quality Plan for the Upper Housatonic River, Final Plan/Environmental Impact Statement. September 1978.

Septage Lagoons and Sludge

Septage

In the Commonwealth of Massachusetts there are approximately 600,000 residential and commercial septic systems being used for the disposal of sanitary sewage in areas not serviced by municipal sewer systems and wastewater treatment plants (Allen and Paré, 1987). **Septage** is the residual scum, sludge and other solids that accumulate in the bottom of the septic tank. For the septic system to function properly, septage must be periodically pumped from the tank.

Septage is a highly concentrated waste with a variable composition, a disagreeable odor and significant quantities of grit, grease and hair. Septage also has the potential to foam, and it resists settling. The annual volume of commercial and domestic septage generated in Massachusetts is estimated to be approximately 400 millions gallons per year (Allen and Paré, 1987).

Common constituents of septage that are potential groundwater contaminants include pathogenic bacteria and viruses, heavy metals, nitrates, sodium and chloride. Of particular concern is the presence of **hazardous organic compounds** - benzene, toluene, 1,1,1-trichloroethane, and 1,1,2-trichloroethane (see section on Solvents) - in **domestic** raw sewage and septic system septage and effluent (USEPA, April 1985). The presence of these toxins and persistent compounds can be attributed to the improper disposal of household hazardous waste, such as paint thinner, turpentine, old gasoline, acetone, wax strippers and grease removers in the septic system. The use of toilet bowl and septic system cleaners also contributes toxic organic solvents to the on-site system.

Lagoons and pits provide a system for the dewatering of septage. They are usually unlined and sited in well-drained, permeable soils. Liquid effluent percolates through the soil or evaporates and the solid portion is retained. Lagoons are slightly more sophisticated than open, unlined pits which are no more than holes dug into the ground. When a pit is full, it is usually covered with fill and buried. However, lagoons equipped with sand filter beds facilitate the percolation of the liquid effluent. Once the septage is sufficiently dewatered, the settled solids are removed from the lagoon and disposed of in a sanitary landfill or spread on agricultural or forested land. New septage is then added to the lagoon.

Unlined pits and lagoons provide **little or no treatment** of septage. As the effluent percolates down through the sand filter beds and soil, some of the bacteria, viruses and phosphorous may be adsorbed and the solids are retained. In addition, some microbial degradation of the septage occurs in both lagoons and pits. However, many groundwater contaminants including nitrate and toxic organic solvents are not removed by this treatment process. The disposal of septage in unlined lagoons and pits is a serious threat to groundwater quality.

In Massachusetts, there are many existing illegal lagoons and pits being used for septage disposal. The DEQE conducted a statewide inventory of septage disposal practices, completed in 1986, that identified 56 operating municipal and private lagoon sites (DEQE, 1986). Only ten of these sites have been given approval to operate on a temporary basis ("interim status") and not one of the sites has a valid discharge permit. Even more alarming is that all 56 sites are located in towns that depend on groundwater for their drinking water supply. Many of the lagoons and pits are located within the recharge areas (Zone II) of water supply wells (Allen and Paré, 1987). Recent investigations (Gallagher and Nickerson, 1986) on Cape Cod conclude that leachate plumes attributable to septage disposal are moving with the groundwater toward municipal wells.

Sludge

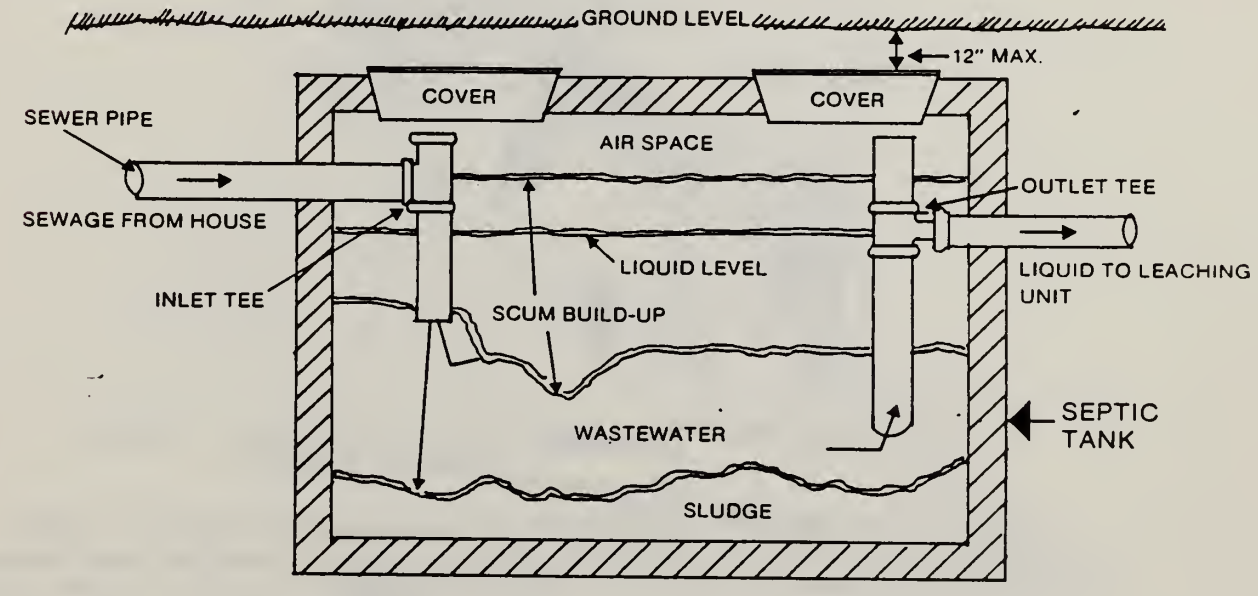
Many municipalities rely upon wastewater treatment plants to process urban and industrial sewage. Before treatment, this sewage may contain sediments, oil, scum, pathogenic bacteria and viruses, salts, pesticides, persistent organic compounds and heavy metals. Over 200,000 tons of sludge, a residual by-product of the treatment process that has a high solids content, is generated by wastewater treatment plants in Massachusetts. Typical municipal sludges contain a large number of potential groundwater contaminants including nitrate, bacteria, viruses, metals and toxic organic compounds. Prior to disposal, sludge is dewatered and stabilized. Disposal options for municipal and industrial sludge include incineration, landfilling and land application.

Since sludge and septage both contain varying concentrations of nitrogen, phosphorus and potassium, they can be used to supplement agricultural fertilizer and condition crop land soil. However, land application of these wastes may be detrimental to water quality. If the site has coarse textured soils, high precipitation rates and a shallow depth to groundwater (high water table) the toxic constituents of the waste such as nitrate, metals or hazardous chemicals can leach through permeable soils and enter the groundwater. In Massachusetts, approximately 80% of the sludge is disposed of in municipal, commercial and on-site landfills (please refer to section on Landfills).

Septic Systems, Cesspools and Water Softeners

In the absence of a communal sewage collection and treatment system or in low density, rural areas, septic systems provide for disposal of household sanitary waste as well as sanitary wastewater generated by a variety of commercial operations.

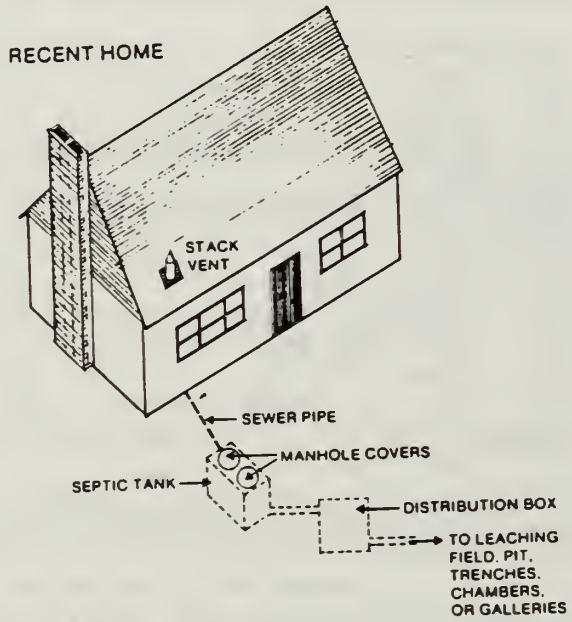
Cross Section View of a Septic Tank



SOURCE: Department of Environmental Quality Engineering Brochure (undated).

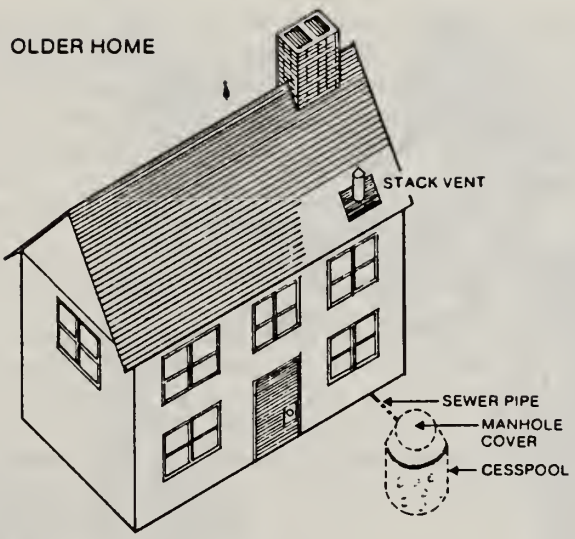
A septic system consists of two units - a watertight septic tank and a leaching system. After the raw sewage enters the septic tank, the heavier solids settle to the bottom and the lighter solids, greases and scum rise to the top. Bacteria in the anaerobic environment of the septic tank decompose the solid material. Gradually, a layer of sludge forms at the bottom of the tank and a layer of scum/grease forms in the upper part of the tank. The sludge, grease and scum (called septage) must be removed periodically to prevent clogging of the leaching system. Effluent from the septic tank flows into the leaching system which may consist of a field, pit, trenches, chambers or galleries that release the effluent to the soil. As the effluent percolates down through the unsaturated zone (soil) some pollutants may be filtered, sorbed or undergo aerobic biodegradation. Septic systems and leaching fields provide very limited treatment to sanitary wastewater. Although most domestic wastewater is relatively generic, the capability of the soils to treat certain contaminants is limited. Sorption, ion exchange and filtration are the common attenuation processes occuring in the soil. Heavy metals,

pathogens and phosphates are immobilized by these processes. However, these attenuation mechanisms are limited by the number of available exhange sites on silt, clay and organic soil particles. Once the exchange capacity of the soil is reached, these contaminants will move through the soil relatively unaffected. Nitrates and volatile organic compounds (solvents) are not removed and held in the septic tank nor are they immobilized in the soil. These contaminants migrate relatively easily through the soils and may enter the groundwater.



SOURCE: Department of Environmental Quality Engineering. Brochure (undated).

Although the installation of a cesspool is no longer permitted in Massachusetts, the sanitary waste from many older houses and summer cottages is discharged into cesspools. Cesspools are perforated concrete or stone chambers. Raw sewage flows into the cesspool, solids settle to the bottom of the chamber and the liquids seep out through openings in the side and bottom of the chamber. Cesspools provide little treatment of sewage and are more likely to fail and create public health problems than septic tanks equipped with leaching fields.

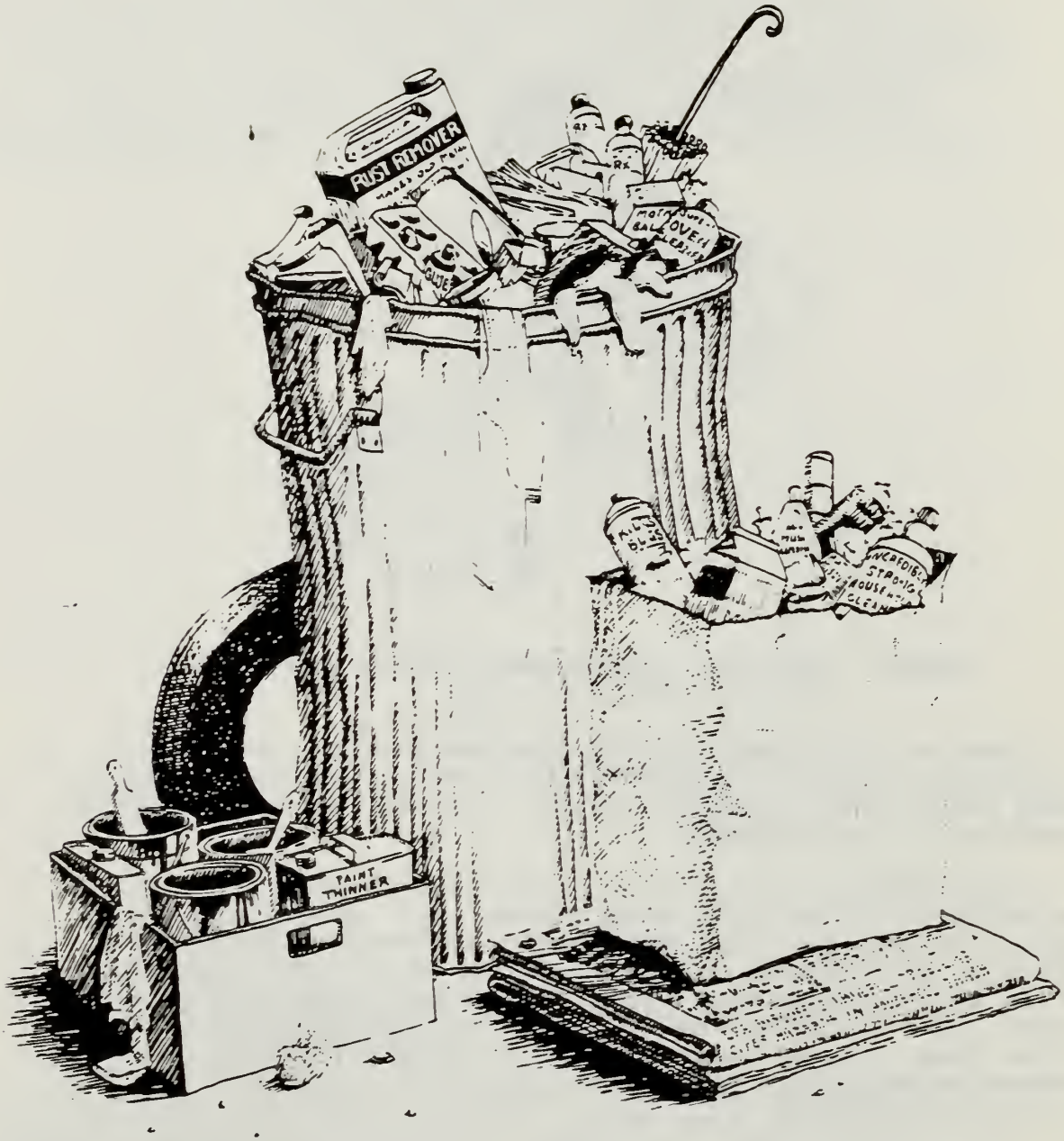


SOURCE: Department of Environmental Quality Engineering. Brochure (undated).

There are several major problems associated with the use of septic systems that can result in the release of pathogenic bacteria and viruses, heavy metals, sodium, chloride, nitrates, petroleum products, solvents and pesticides to the groundwater.

Nitrate (NO_3^-) is one of the most common groundwater contaminants associated with septic systems. Once nitrate enters the groundwater system, it moves with minimal transformation. Nitrate is as **mobile** as the groundwater and may travel long distances from input areas if the aquifer materials are highly permeable and contain dissolved oxygen. Excess concentrations of nitrates in drinking water give it a bitter taste. Nitrate concentrations above 10 mg/l can cause methemoglobinemia ("blue baby disease") in infants (please refer to section on Nitrates).

Of particular concern is the presence of **toxic organic solvents** in domestic wastewater, septage and discharged effluent (USEPA, April 1985). The improper disposal of household hazardous wastes and the use of certain products contribute solvents, petroleum products and pesticides to the on-site system. The septic system cannot treat these wastes effectively; therefore, the effluent entering the underlying soils will contain varying concentrations of these solvents and other contaminants.



Common Household Trash Can Contain a Variety of Hazardous Wastes Which Should Not Be Poured Down the Drain

SOURCE: U.S. Environmental Protection Agency, Office of Solid Waste, November 1986.

Key Problems Associated With Septic Systems

I. Location of Septic Systems

A. Siting new systems in highly permeable soils that have a limited fine component (silt and clay) will provide less treatment to the effluent than soils that contain silt and clay particles. Sorption and ion exchange attenuation processes that immobilize heavy metals and phosphates occur on the silt and clay particles. In addition these particles filter the pathogens (bacteria/viruses).

B. Old/Existing Systems

- o presence of impermeable soils may result in mounding of the effluent or flooding of the system
- o if the leaching system is too close to the seasonal high water table the system may flood or fail resulting in a discharge of effluent to the groundwater
- o stormwater flooding of systems due to siting in depressions or swales

II. Maintenance of Septic Systems

A. Failure to pump septage every 2-3 years may cause the sludge and scum layers to overflow into leaching system resulting in system failure

B. Use of septic tank and cesspool cleaners to avoid pumping of the tank:

- o these cleaners kill the necessary bacteria and upset the biodegradation process
- o these cleaners do not eliminate scum and sludge buildup
- o septic tank and cesspool cleaners are not a substitute for routine pumping of the septage
- o many of these cleaners contain halogenated hydrocarbons (see section on Solvents)
- o septic tank cleaners have been linked to groundwater contamination by the organic solvents trichloroethylene and trichloroethane (Canter and Knox, 1986; EPA, April 1985)

III. Use of Septic Systems

A. Improper disposal of household hazardous waste into the septic system i.e., pesticides, petroleum products, and solvents.

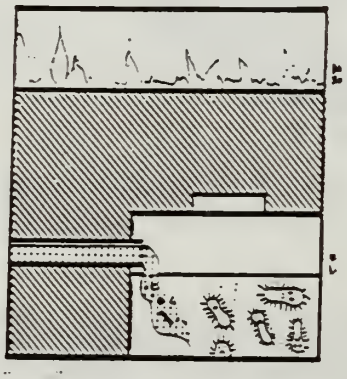
- o These products contain benzene, toluene, 1,1,1-trichloroethane and 1,1,2-trichloroethane. These contaminants have been found in domestic wastewater, septage and discharged effluent (DeWalle, et al., 1985). The septic system cannot treat this waste. (Refer to section on Solvents)

B. If the current waste loading exceeds the design capacity of the system, (i.e., summer cottages with cesspool or septic system now used year-round) the system may fail.

Organic Chemicals Associated with Consumer Products Disposed into On-Site Systems

Type of Product	Contaminant
General Household Cleaners	petroleum distillates glycol ethers xylenols isopropanol
Drain Cleaners	1,1,1-trichloroethane
Toilet Cleaners	chlorinated phenols xylene sulphonates
Laundry Soil and Stain Remover	petroleum distillates tetrachlorethylene
Spot Removers and Cleaning Fluids	petroleum hydrocarbons benzene trichlroethylene 1,1,1-trichloroethane
Paint Brush Cleaners	aliphatic hydrocarbons toluene acetone methylethyl ketone methanol glycol ethers
Rug and Fabric Cleaners	carbon tetrachloride trichloroethylene

SOURCE: Koppelman, et al., Non-Point Source Management Handbook, Long Island Regional Planning Board, Hauppauge, NY, 1984.



Manage What Goes Into the Septic System

SOURCE: Save The Bay, Inc. brochure (undated)

Natural Alternatives to Toxic Household Chemicals[13]

Furniture Polish	dissolve 1 tsp. lemon oil into 1 pint mineral oil or apply mayonnaise to remove water spots on wood furniture, set over night, then sand with a dry dish pad or pot scrubbing pad, or use 1/2 cup vinergar, 1/2 cup rubbing alcohol.
Garden Herbicides/Insecticides	strong hosing, or use natural insecticides like ROTENONE or predators like lady bugs or praying mantises.
Pesticides	remove and destroy infected plants, use resistant plant varieties, or use barriers and traps, tar paper, etc. Use organic gardening techniques.
Silver Polish	soak silver in 1 quart warm waer with 1 tsp. baking soda, 1 tsp. salt and a small piece of aluminum foil. Boil for 3 minutes.
Drain Cleaners	pour boiling water down drain, or use plunger, or use metal snake, or baking soda.
Liquid Chlorine Bleach	use dry bleaches or use borax to whiten.
Toliet Bowl Cleaners	baking soda, or mild detergent, or small amounts of bleach, or can of cola, or denture tablets, or TANG.
Abrasive Scouring Powders	make a paste of baking soda and water, or use Bon Ami Brand.
Spot Removers	club soda, or immediate cold water soak, or corn meal and water soak, or lemon juice.

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[13] adapted from a Cape Cod Planning and Economic Development Commission flyer (based on information obtained from the Nashua Regional Solid Waste District).

BEST MANAGEMENT PRACTICES
Septic Systems

Septic System Maintenance

- The board of health should adopt regulations that establish a **mandatory maintenance program** that requires registration and periodic inspection and cleaning of systems.

- The board of health should initiate a **public information program** to inform homeowners of proper maintenance procedures. Brochures are available from the DEQE. The board may wish to develop its own Homeowner's Guide. The information can be disseminated through a special mailing or included with the water bill or other town-wide mailings.

- The board of health should develop an effective program to identify and locate malfunctioning septic systems. One way to meet this goal would be to adopt a health board regulation that requires all existing subsurface disposal systems be upgraded to meet Title 5 standards before a residential dwelling can be sold; or before a permit is issued for the renovation/expansion of an existing structure.

- The board of health should require septage haulers, as a precondition to the issuance of a Septage Handler's Permit, to check the condition of each tank the company inspects including the baffles, inlet and outlet tees, manhole, seal and cover.

- The board of health should adopt regulations banning the use of all septic tank cleaners containing organic solvents.

Depth to Groundwater Measurements:

- The Board of Health should limit groundwater elevation measurements to the wettest periods of year: March, April and May. Until the DEQE issues revisions to Title 5, Health Boards should consider installing test wells or standpipes in different parts of the town in order to monitor groundwater elevations. Boards should allow testing only while the water level in these wells is at its highest.

Inventory

- The Board of Health should determine the location of all septic systems within the Zone II (primary recharge area) of public supply wells and conduct periodic inspections of these systems. The Board should maintain an up-to-date filing system that includes information on installation date, map location, name of owner, and condition of system.

BEST MANAGEMENT PRACTICES
Septic Systems

Preventing System Failures[14]

- DO NOT use garbage disposals; they add massive amounts of solids to the septic tank and are a leading factor of clogged systems.
- DO NOT dispose of disposable diapers, sanitary napkins, paper towels, colored toliet paper or tissues in the septic system; these wastes do not decompose.
- DO NOT put fat, grease, and oil (including cooking oil) down the drain; they can pass through the septic tank and clog the leaching field.
- INSPECT on-site systems each year.
- PUMP OUT on-site systems every two to three years.
- CONSERVE WATER: the less water used, the longer the retention period in the tank and the more solids the bacteria can decompose. Install water saving devices.
- DO NOT use enzymes or acid for treating your septic tank or cesspool.
- AVOID extreme peak flows by spacing out laundry loads, bathing and dishwashing.
- DO NOT put chemicals into the cesspool or leach pit for the purpose of maintaining or declogging it. There are no known chemicals, yeasts, bacteria, enzymes or other substances capable of eliminating or reducing the sludge and scum so that periodic cleaning is unnecessary. Many of these cleaners contain highly concentrated organic solvents that are not biodegradable and pose a serious threat to water supply wells.
- DO NOT dispose of pesticides, disinfectants, acids, medicine, paint thinners and other household hazardous wastes in the the septic system. These wastes will kill the helpful bacteria in the tank and may contaminate the groundwater. Such household hazardous wastes should be collected at a community-sponsored Household Hazardous Waste Collection Day (contact Barbara Kelley, DEM Office of Safe Waste Management (617) 727-3260 for more information).

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[14] adapted from a Department of Environmental Quality Engineering brochure: "What You Should Know in Order to Identify and Maintain Your Sewage System" (undated).

STABLES, FEEDLOTS, KENNELS, PIGGERIES, MANURE PITS

Typically, feedlots are areas in which a large number of cattle, poultry, sheep or hogs are confined in concentrated spaces. Wastes generated by feedlot operations include manure, chemicals and debris.

Precipitation falling on the feedlot infiltrates the accumulated animal wastes and produces leachate containing various concentrations of bacteria, viruses, nitrate-nitrogen, phosphate and sodium. Leachate or runoff from the feedlot may enter the groundwater system by infiltrating the soil cover. Groundwater contamination may also result from leachate produced when animal wastes are collected from the feedlot and applied directly to the land or disposed of in an unlined manure pit. Although usually generated in smaller quantities than feedlot wastes, animal wastes from kennels and stables are also potential groundwater contaminants.

BEST MANAGEMENT PRACTICES (DEQE, 1985)
Stables, Feedlots, Kennels, Piggeries and Manure Pits

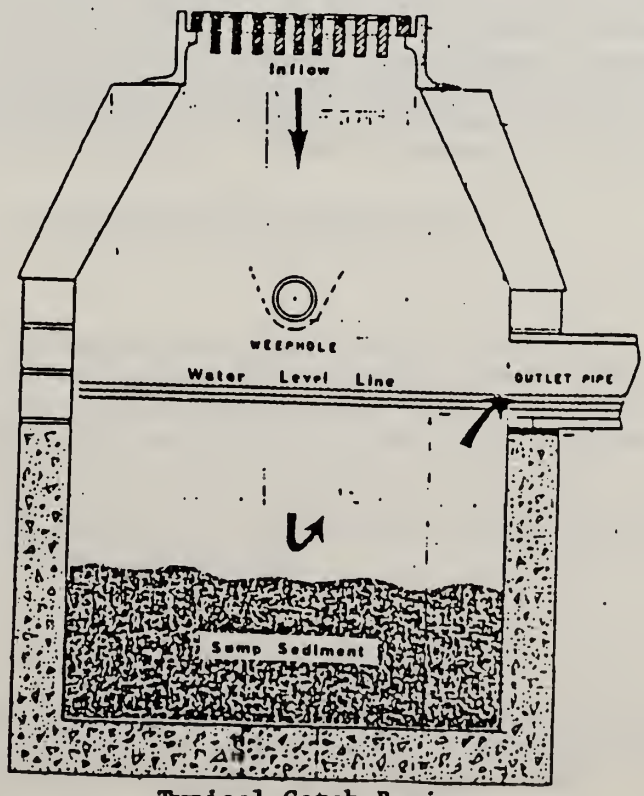
Feedlots -	o Divert runoff from feedlot area - install upslope berms and/or diversion ditches - collect rainfall from roofs
	o Minimize runoff from feedlot by grading or reshaping area
	o Collect runoff from feedlot with ditches or a tile drainage network
	o Treatment of runoff - land application - holding ponds
	o Periodic scraping of paved feedlots
	o Vegetative buffer zone downslope of feedlot to detain and absorb wastes
	o Low slope-low gradient ditches around feedlot to reduce runoff velocity
Manure Pits -	o Manure pits should be lined with clay or other impermeable material
	o Liquid effluent should be collected and treated
Stables/Kennels -	o Divert/minimize runoff from stable/kennel area

Stormwater Drains and Retention Basins

Stormwater runoff is the excess precipitation that flows over the land surface to streams, lakes and other surface waters. In undeveloped areas most of the precipitation infiltrates the soil and supplies recharge water to the aquifer, thereby reducing the volume of runoff and rate of overland flow. In developed areas, however, two factors influence the volume and rate of flow of storm water runoff - 1) the amount of impervious (paved or otherwise covered) surface area; 2) the stormwater control features. An increase in impervious surface area reduces the amount of infiltrating water and increases the volume of surface runoff.

Stormwater can pick up and transport **sodium, chloride, pathogens, heavy metals, petroleum products, solvents and pesticides** from numerous sources including animal feedlots, roads, agricultural lands, parking lots, storage and disposal facilities for industrial, commercial and domestic wastes.

A catch basin is a settling chamber installed in a storm drain to retain heavy debris such as dirt, leaves and other refuse (called sump sediment). When storm drains are connected to the sewer system, catch basins prevent clogging of the pipes. Catch basins may also be connected to pipes that discharge the stormwater to streams or other surface water bodies. Generally, in unsewered areas, leaching catch basins collect stormwater runoff. Water percolates down through the sump sediments and drains from the catch basin by infiltrating the underlying soils.



Typical Catch Basin

SOURCE: Metropolitan Area Planning Council, December 1983.

Without routine maintenance, catch basins can increase the concentration of contaminants in stormwater. Sump sediment that is not removed on a regular basis is churned up and resuspended when stormwater enters the catch basin. Contaminants in the sediments are carried with the turbid stormwater as it flows through the outlet pipe into the sewer system or surface water body. Stormwater flowing into leaching catch basins that have not been properly maintained will percolate down through a thick layer of sump sediments. Contaminants in the sediments are leached out and carried with the water as it infiltrates the underlying soils. An accumulated layer of sump sediment in a leaching catch basin also reduces the rate at which the stormwater infiltrates the soils.

Retention basins reduce the velocity of stormwater runoff by holding and releasing water at a controlled rate. When stormwater enters the retention basin, sediment settles to the bottom while oil and grease rise to the top. Retention basins gradually discharge accumulated water through the underlying soils. Some basins are equipped with overflow systems that discharge excess water to surface water bodies. Like sump sediments in catch basins, settled sediments in retention ponds must be periodically removed. Otherwise, incoming stormwater churns up the accumulated sediments and additional contaminants are released to the water that infiltrates the underlying soil.

In heavily developed, unsewered areas, leaching catch basins and retention basins do not effectively treat stormwater before discharging it to the soils. The soil has a limited capacity to attenuate heavy metals and filter pathogens. Runoff that contains mobile contaminants such as sodium, chloride, solvents and gasoline passes through leaching catch basins and retention basins relatively untreated. Although these stormwater collection systems were designed to provide recharge water to the groundwater system, leaching catch basins and retention ponds generally do not provide adequate treatment and discharge water that can be a serious threat to groundwater quality.

BEST MANAGEMENT PRACTICES [15]
Stormwater Drains and Retention Basins

- Streetsweeping: Street sweepers remove litter, dirt and some of the larger sediment particles. Current research has indicated that the most important contaminants such as heavy metals and nutrients are attached to the smallest sediment particles (the "fines") which the broom sweepers do not remove.

- Vacuum sweeping: With a vacuum attachment, street sweepers can remove more than 90 percent of the solids, including the fines.

- Catch basins: Sump sediments from sealed catch basins should be removed at least twice a year. A regular maintenance schedule should be established. Catch basins can be dredged with buckets or vacuumed using a vacuum street cleaner or large vacuum truck called an eductor.

- Leaching catch basins should be cleaned more frequently than sealed catch basins because soil clogging will interfere with percolation.

- Sediments should be periodically removed from retention basins.

- In order to reduce the amount of nutrients (including nitrates) and pesticides in stormwater runoff, towns should encourage the reduction in the amount of fertilizer and pesticides applied to residential lawns, golf courses and agricultural lands through Integrated Pest Management and/or the proper use and application of these chemicals (see Best Management Practices section for Agriculture/Golf Courses).

Contaminant Collection Devices

Oil Separators/Traps:

Oil separators (also called oil traps) can be installed in catch basins to remove the oil and grease in stormwater runoff. These devices exploit the relationship between oil and water; the two do not mix. In addition, oil is lighter than water and thus the oil will float on top of the water. Runoff enters the catch basin and the oil floats to the top of the basin while the water remains at the bottom. The design of the oil separator allows the stormwater to discharge into the drainage system while the oil remains in the catch basin.

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[15] adapted from Metropolitan Area Planning Council, "Runoff and Recharge: Improving Water Quality and Groundwater Recharge Through Alternative Drainage Designs," Boston, MA. December 1983.

BEST MANAGEMENT PRACTICES
Stormwater Drains/Retention Basins

- To be effective, the trapped oil and grease must be removed from the oil traps after each storm. Otherwise, the runoff from subsequent storms will resuspend or emulsify the oil and the contaminated water will be discharged through the outlet.

Sorbents:

Sorbent pads, pillows or granules are made of synthetic fibers such as polypropylene that absorb oil and repel water. Sorbent pads are generally used when oil spills are not large enough to require clean up by vacuum hoses or other mechanical means. Generally, sorbent pads or pillows are used in conjunction with sealed catch basins and oil traps or leaching catch basins. The sorbents float on the surface and absorb the oil that rises to the top of the water. Sorbents are an inexpensive and effective means of removing oil and grease in catch basins.

The permit issued by a local conservation commission or planning board can require a developer to install and provide for the maintenance of specific stormwater drainage controls including leaching catch basins and sorbents or sealed catch basins with oil traps and sorbents. Towns are under no obligation to assume responsibility for the maintenance of stormwater drainage facilities installed in new subdivisions, cluster developments, condominium developments or commercial developments such as shopping malls. A town can require the developer to guarantee the maintenance of the drainage facilities by including in the permit the requirement that the developer form a Homeowners' Association, Condominium Association or similar Trust that would bind all users of the drainage system and make them collectively responsible for the operation, maintenance and repair of the catch basins, oil traps and sorbents.

Sorbents have a limited capacity to absorb oil. After several months, they begin to degrade and oil will leak out of the sorbent and back into the water. Therefore, a regular maintenance program must be established to remove and replace used sorbents.

Best Management Practices on Public Roadways

- Towns should establish a regular maintenance program to remove and replace sorbents in catch basins that drain public roadways.

- Sorbents saturated with oil are a hazardous waste and must be disposed of through a licensed hazardous waste transporter. The town Department of Public Works (DPW) crew should collect the used sorbents, place them in sealed 55 gallon drums and store the drums with the DPW's other hazardous wastes (i.e., used solvents and motor oil). The DPW must include the volume of used sorbents collected each month when determining its generator status for waste oil.

BEST MANAGEMENT PRACTICES
Stormwater Drains/Retention Basins

- In order to save money on cleaning services, towns should consider cooperating with other towns and individuals responsible for the maintenance of catch basins by negotiating collectively for cleaning services from the same company. When the scheduled cleaning routes are consolidated, transportation and disposal costs can be reduced.

Best Management Practices for Private Property

- The town conservation commission and planning board should require developers to install and provide for the maintenance of leaching catch basins and sorbents or sealed catch basins, oil traps and sorbents (whichever is appropriate) as a performance standard for the issuance of permit or a requirement in the "orders of condition."

  There are several licensed firms that will establish scheduled maintenance for removing oil and used sorbents from catch basins located on private property such as shopping malls or residential developments.

- Local boards can monitor this maintenance program by requiring the client to send the board a copy of the annual contract with the firm that details the cleaning schedule (i.e., cleaning is performed on a daily, weekly, monthly or semi-annually basis).

Stump Dumps

The clearing of land for agricultural use and commercial, residential or other development projects produces quantities of trees, brush, leaves, stumps and other woodwastes which are commonly referred to as "bulky wastes." Generally, the operators of municipal and commercial landfills are reluctant to allow the disposal of large quantities of woodwastes because they reduce the landfill's capacity and interfere with refuse disposal. Resource recovery incinerators do not use stumps or woodwastes for fuel because they may plug the feed and ash chutes, or be incompletely burned in the incinerator.

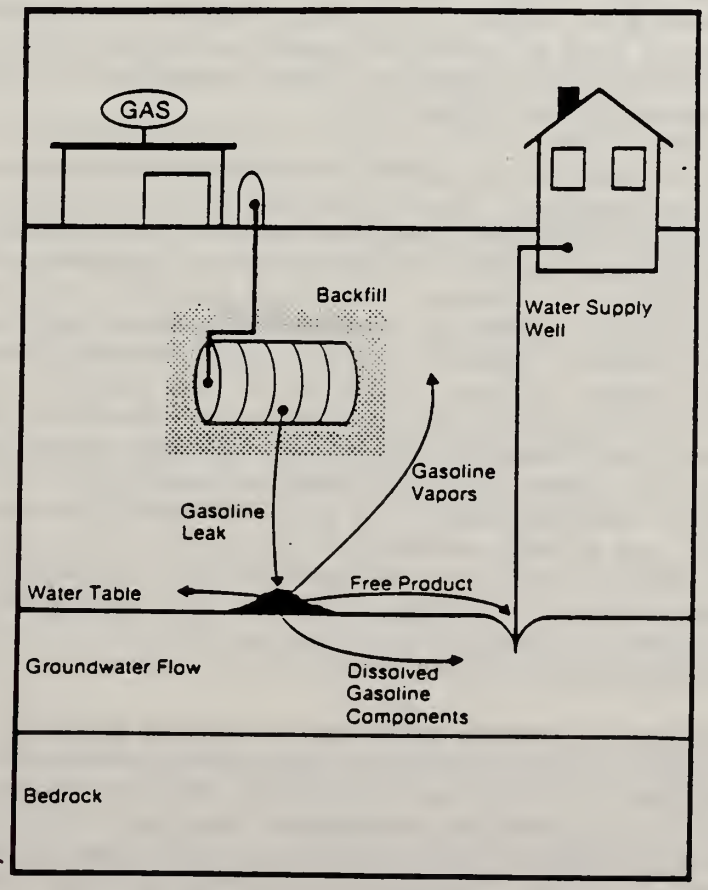
Even with large, properly supervised woodwaste disposal sites, the potential may exist for future contamination of groundwater from the organic acids, i.e., tannic acids, produced as the woodwastes decompose (DEQE, 1987; to date there are no documented examples in Massachusetts). The threat to groundwater is much greater from unmonitored stump dumps, especially those sited for convenience in abandoned sand and gravel pits or other sensitive aquifer recharge areas.

Illegal or unmonitored dumping practices would result in a leachate that may contain a number of different toxic constituents depending on the type of wastes. For example, the dumping of waste oil, paint thinner, and salt-laden snow would contribute hydrocarbons, solvents, sodium, and chloride to the organic acids in the stump dump leachate (please see appropriate discussions listed in the Contaminants section).

Underground Storage Tanks (USTs)

Underground storage tank systems (USTs) are used by many types of businesses to store gasoline and other fuels, heating oil, solvents, raw materials for processing, and hazardous wastes. Highway departments, trucking companies, and service stations store gasoline, diesel fuel, and waste oil in underground storage tanks. Municipal facilities, public and private institutions such as hospitals, schools, libraries, and households store heating fuel in underground storage tanks.

Tank capacity varies from 50 to 25,000 gallons or more. Each underground tank is a potential threat to groundwater quality. Cleanup costs may be prohibitively expensive. For example, it took over three million dollars and nine years to clean up Provincetown's South Hollow wellfield (located in the neighboring town of Truro) after gasoline from a leaking underground storage tank contaminated the groundwater.



SOURCE: New England Interstate Water Pollution Control Commission (NEIWPCC), January 1985.

Leaks from underground storage tank systems result from defects in tank materials, improper installation, corrosion, or mechanical failure of the pipes and fittings. Most early underground tanks were simply designed and manufactured from bare carbon steel (the use of bare steel tanks is now illegal). The corrosion of these bare steel tanks is by far the most serious cause of leaks threatening groundwater quality. In addition, there have also been problems with the improper installation of new USTs. Leaks from fittings or tanks damaged during installation are a serious threat to groundwater.

Many steel tanks still in use are aging and have little or no protection against the corrosive action of the soil and water. The exact age, condition and location of many existing tanks are unknown, making it extremely difficult to predict or prevent leaks. Current technology has made available several alternatives to the bare steel underground storage tank to aid in the prevention of leaks including double walled tanks, coated steel tanks, fiberglass reinforced plastic (FRP) tanks, clay liners, polymeric liners, and concrete vaults. Unfortunately, even these tanks, liners, and vaults may fail. The installation of monitoring wells, vapor sensors and line leak detectors will alert a tank owner to a release of a product from the tank or piping. Leak detection devices may provide enough advance warning to enable a tank owner to contain the leak and remove contaminated soil before the product reaches the groundwater. Tank owners and owners of land in which the tanks are buried are legally responsible for cleanup costs under the 1983 Massachusetts Superfund Act (Massachusetts General Laws Chapter 21E).

Although pesticides and solvents are stored in underground storage tanks, fuel such as gasoline, diesel fuel and heating oil are by far the most common material placed in underground tanks. Fuel from a leaking underground storage tank results in contaminated soil and groundwater that is especially difficult to cleanup. Gasoline and fuel oil are not easily dissolved in water (low solubility) and are less dense than water so they float on the water table. However, several gasoline additives - benzene, toluene and MTBE (methyl tertiary butyl ether) are soluble and will dissolve in the groundwater as the gasoline plume floats on the water table. When fuel from a leak or spill moves through the soil above the water table, the fuel coats the soil particles and leaves behind a residue of fuel trapped in the soil pores. As rain and melting snow percolate through the soil, the soluble components of the fuel (the gasoline additives) will be flushed out. Once in solution, these highly mobile contaminants move with the recharge water and enter the groundwater system. (Please refer to Pesticides, Petroleum Products, and Solvents discussions for additional information.)

Leaking underground storage tanks are a serious threat to local pulic water supply wells. There are several regulatory techniques that local communities can adopt to supplement the state laws and provide increased protection for their vulnerable groundwater supplies. At first glance, the adoption of local protection measures may seem costly and difficult to enforce. However, when the costs of implementing a local strategy to protect a water supply from contamination by leaking UST are compared to the costs of cleaning up or replacing a contaminated water supply, the local protection measures are by far less expensive.

BEST MANAGEMENT PRACTICES
Underground Storage Tanks (UST) [16]

Developing a Local Program to Prevent the Contamination of Public Water Supplies by Leaking UST

Determine the Location of all UST in the Community (including all abandoned tanks).

- Maintain an up-to-date filing system for UST that includes information on:
  - * installation date
  - * type and volume of tank
  - * product stored in the tank
  - * name and address of tank owner
  - * condition of the tank (if known)

- Long-time residents often know the location of abandoned tanks.

Remove all abandoned tanks and dispose of the tanks properly

- State regulations (527 CMR 10.12 (2)) require that abandoned, licensed tanks be removed.

- Adopt local regulations to require removal of all abandoned tanks.

- At the very least, abandoned tanks should be emptied and filled with an inert material such as washed sand.

Set additional standards for <u>new</u> and <u>replacement</u> UST that are appropriate for your community.

- Assume all soils are corrosive; require corrosion protection for all new tanks and piping.

- Require a striker plate to be installed under each tank opening to prevent damage to the tank during dip stick tests.

- Regulate all new UST, including heating oil tanks.

- Consider banning all new underground heating oil tanks (including residential tanks).

- Require state-of-the-art technology for all new underground storage installations.

- **Prohibit** all new UST where they are likely to contaminate water supplies, such as within the primary recharge area of a public supply well (Zone II). If prohibition is not a viable option, require double containment for both tanks and piping as well as leak-detection sensors for tanks in Zone II areas.

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[16] adapted from Massachusetts Audubon Society, Groundwater Information Flyer #5, December 1984.

- Require all new and replacement tanks and piping to be installed according to manufacturer's instructions. Inspect all installations. Require installers to present evidence that they have successfully completed a manufacturer's training course on tank installation.

- Once a new tank system is in place, require a tightness test for the complete system before the tank is filled.

Best Management Practices for existing UST

- Strictly enforce inventory control requirements.

- Require regular testing of tanks and piping.

- Require annual testing of unprotected steel tanks and piping systems aged 15 years or more.

- Encourage tank owners to upgrade existing UST and piping systems by requiring less frequent testing where leak-detection sensors are installed or where cathodic proteciton and electrical isolation are installed.

Best Management Practices for all UST

- Require periodic license renewals. This allows local officials to inspect the daily inventory records and require tightness tests if appropriate. For example, require tank owners to renew their licenses every five years from the date of installation up to the fifteenth year and then annually thereafter. If the installation date is unknown, the license renewal should be required every year.

- Require tightness testing of all tanks and piping systems before licenses can be renewed.

- Require immediate tightness testing when leaks are indicated by inventory loss, leak-detection system, fumes or other evidence, or when daily inventory records have not been maintained or are suspect.

- Require repair or replacement of tanks and piping systems when tests indicate the need. Require the replacement of old metal piping when new metal tanks are installed. Require the replacement of all steel tanks in a facility when one must be replaced.

- Require the removal of all leaking tanks and piping unless repairs can be made to upgrade them to state standards (527 CMR 9.06.17 (e)).

- Require accurate and expeditious reporting, monitoring and testing procedures for leak incidents.

- Include fines or other penalties (as allowed by state law) for noncompliance.

Choose the appropriate regulatory measure(s) for your community.

- Decide whether zoning, town bylaws or city ordinances or health board regulations (or a combination of these measures) is the best approach for managing the risk of UST in your community.

LOCAL REGULATORY TECHNIQUES FOR MANAGING UNDERGROUND STORAGE TANKS

Zoning Bylaws: For public supply wells, the most important area to protect is the primary recharge area of a public supply well - the Zone II area.

- Aquifer protection zoning can **prohibit** the installation of new UST within the Zone II area of a public supply well or allow the installation of UST in this area only by a special permit that requires the appropriate protective measures and devices discussed above.

- If the Zone II area has not been delineated, zoning bylaws can prohibit the installation of UST and the storage of other hazardous material within a certain, resonable distance from a public water supply well.

General Town Bylaws/City Ordinances: Communities can adopt general bylaws or ordinances that establish standards for both new and **existing** UST. These regulations must apply to UST throughout the entire community. By adopting a general town bylaw or city ordinance a community can require UST owners to:

  * Provide corrosion protection for new steel tanks and piping systems (including heating oil tanks).
  * Leak detection devices for all new tanks.
  * Regular reporting procedures for all tank operators.

- The Conservation Law Foundation of New England, Inc. (CLF) has developed a model bylaw/ordinance that supplements the fire chief's role in enforcing state UST regulations by assigning the Board of Health a major role in the regulation of UST. This responsibility could also be given to the selectmen or the fire chief. The CLF model bylaw gives the Board of Health the following powers:

  * Control over the location of new tanks.
  * The right to obtain information.
  * The authority to enforce the bylaws.

* Require a permit from the Board of Health for all new tanks in addition to the permit or license required by state regulations.
* If the Board of Health determines that the UST is a threat to a public water supply, the Board may deny the permit or require secondary containment systems and monitoring devices as part of the requirements for issuance of a permit.

Health Board Regulations: Massachusetts General Laws, chapter 111, section 31 gives local boards of health extensive power to adopt regulations to protect public health. The Conservation Law Foundation's model bylaw could be adopted as a health board regulation.

Enforcement of state and local regulations.

o Recent amendments to the Board of Fire Prevention Regulations, 527 CMR 9.00, include:

- By January 1, 1989, all new and replacement tanks must be double-walled (secondary containment around the entire tank). The only tanks exempt from this requirement are those that meet the following two requirements: (1) the tank must have a capacity of less than 1100 gallons and (2) the tank must be used for the storage of heating oil used for domestic and commercial consumptive use.

Please contact Deirdre Doherty, UST Coordinator, DEQE at (617) 292-5886) for additional information.

o Proposed amendments include:

- Secondary containment for piping systems and interstitial monitoring.

o Fully enforce all state and local regulations. Local officials should obtain copies of the state regulations for UST (527 CMR 5.05; 9.00 and 10.12) from the State House Bookstore, State House, Room 116, Boston, MA 02133 or call (617) 727-2834.

o Allocate staff from the fire department to enforce the state regulations. This staff should also regularly inspect all UST inventory records.

o Commit financial and staff resource to the enforcement of local UST regulations.

- Consider cooperating with neighboring towns to enforce local UST regulations. For example, one person could be hired to inspect and enforce the regulations in several towns.

- **Remember, even the best-planned, most comprehensive regulation is <u>ineffective</u> if it is not enforced.**

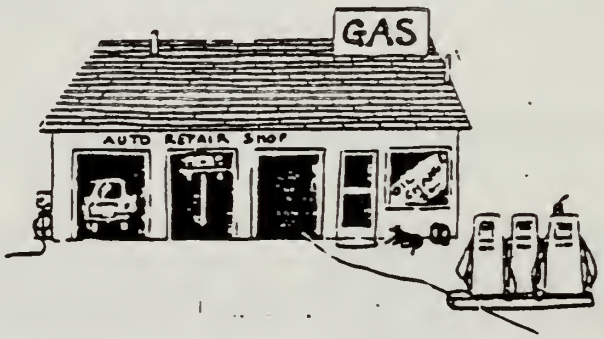
- **The most common reason for failure of local regulatory programs for UST is <u>lack of enforcement</u>.**

Vehicular Services[17]

Automotive service stations, body shops, fuel stations, automotive dealerships and rustproofing operations are included in the vehicular services category. Products used in the daily operations of these businesses include gasoline, diesel fuel, antifreeze, oil and degreasing solvents. The most common waste products generated by vehicular service operations are waste oil, fuel, antifreeze, solvents, used filters and batteries. Groundwater contamination results from the improper storage and disposal of products, careless/accidental spills, leaks and the release of wastes to floor drains. Vehicular service operations normally have underground storage tanks for fuel and oil. These tanks and their pipes are a potential threat to groundwater quality if they are old, rusty or leaking (see section on Underground Storage Tanks).

All of the business listed above, except the automotive rustproofing operations, provide similar services and generate similar types of waste products. The wastes produced normally include used oil and filters from oil changes, old antifreeze from cooling systems, spent solvents from the cleaning/degreasing of parts, and waste fuel and filters from fuel filter changes.

Generally, automotive rustproofing businesses use fuels or solvents such as kerosene or mineral spirits to clean painted surfaces of the automobile and spray equipment. Prior to applying the rustproofing material, a pressure hose is used to clean oil, grease, dirt and fuel from the undercarriage of the car. This water and the water used to wash down the floor will become contaminated with varying amounts of fuel, oil, antifreeze or solvent. Other activities which may result in the contamination of water supplies are careless disposal of used fuel and oil filters and other engine parts, dumping of petroleum products on land adjacent to the buildings and spills or leaks from aboveground storage tanks.



SOURCE: U.S. Environmental Protection Agency, Office of Solid Waste, November 1986.

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[17] Information describing the operational processes and procedures for this business was obtained from the Connecticut Department of Environmental Protection, "Protecting Connecticut's Groundwater: A Guide to Groundwater Protection for Local Officials." 1984.

BEST MANAGEMENT PRACTICES
Vehicular Services

Waste Type	Management
Oil Diesel Fuel	Do not mix the waste with anything e.g., kerosene or gasoline
Solvents (thinner or degreaser)	Store in tightly covered containers
Gasoline	Store containers as full as possible to prevent vapors and the chance of explosion
Batteries	If the batteries are cracked and leaking acid, they are a hazardous waste and must be shipped with a manifest via a DEQE-licensed hazardous waste transporter. To avoid leakage, batteries should be stored on pallets, banded and protected from the elements and unauthorized handling. Batteries that remain intact are not a hazardous waste and can be transported as a hazardous material to a reclaimer. Reclaimers may not be willing to accept small numbers of batteries. It is recommended that businesses work with distributors that will accept dead batteries in exchange for new ones.

- o Floor drains should be connected to a holding tank or sanitary sewer equipped with an oil and grit separating tank.
- o Wastes collected in a holding tank must be disposed of through a licensed hazardous waste transporter.
- o Large drip pan should be kept beneath the spigots of drums that are stored in a horizontal position on racks.
- o Cleaning rags contaminated with paint, solvents, oil or gasoline should be recycled through a rag rental/cleaning service.
- o Outdoor storage facilities should have a permanent roof to prevent precipitation and sunlight from entering the storage area.
- o Refer to section on Underground Storage Tanks for additional BMPs.

BEST MANAGEMENT PRACTICES
Vehicular Services
UNDERGROUND TANKS STORING WASTE OIL

Tanks are considered to be underground when any portion is below ground or if the bottom is resting on the ground. Underground tanks are categorized as existing or new. Existing tanks are those installed before October 15. 1983 and new tanks are those installed on or after October 15, 1983.

General Operating Requirements For All Underground Waste Oil Tanks
(310 CMR 30.695 - 30.696)

The owner of the underground tank or an authorized representative must:

- o Prevent overfilling of tank by using appropriate controls and practices such as:
  - * Install a by-pass system to a standby tank
  - * Install a waste feed cut-off system
- o Check the tank at least once a day to ensure that it is in good working order.
  - * Inspect controls that prevent overfilling
  - * Gather data from temperature and pressure gauges or other monitoring equipment
- o Check the area around the tank at least once a week for obvious signs of leakage.

Labeling Waste Oil Tanks [310 CMR 30.340 (1) (b)]

- o Each tank must be clearly marked and labeled throughout the period of accumulation with a sign that reads:
  - * Hazardous Waste
  - * Waste Oil
  - * Toxic
  - * The date on which accumulation began

Testing Requirements for Existing Underground Waste Oil Tanks
[310 CMR 30.235 (1) (h) and 30.340 (1) (a) 2.b]

Leak Detection Tests are required for tanks installed before October 15, 1983 if they do not have a notice of the test results must be sent to the DEQE within 7 days.

Every 12 months a dip stick test must be performed except the tank must be sealed for 48 hours between measurements.

Dip stick test results must be recorded in a log, dated and signed by the tank owner or designated representative. All test records must be kept for at least 3 years, or for the duration of any enforcement action, or as requested by DEQE, whichever is longer.

BEST MANAGEMENT PRACTICES
Vehicular Services

Design Standards for New Underground Waste Oil Tanks
[310 CMR 30.253 (1) (g) and 30.340 (1) (a) 2.b]

Underground storage tanks installed after October 15, 1983 must meet one of two requirements.

1. The tank must be constructed of corrosion-resistant material such as fiberglass-reinforced plastic or externally coated or cathodically protected steel.

or

2. The tank must have a secondary containment structure and a monitoring system to detect leaks between the tank and the secondary containment structure and to detect water inflow.

In addition, the tank must be equipped with a striker plate to protect the tank bottom from wear or puncture during the dip stick test. There must also be a manhole large enough for a person to enter and inspect the tank.

Wood-Preserving

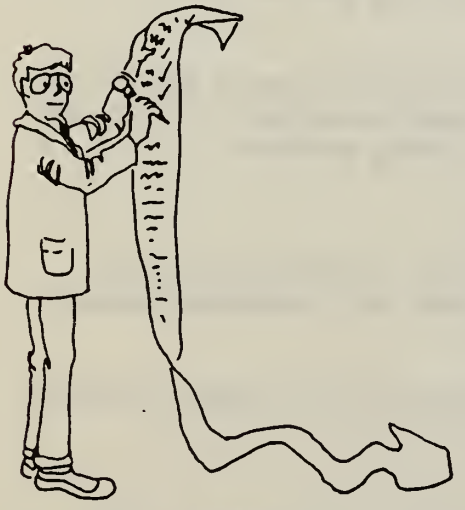
Wood used in the construction of outdoor decks, fences, boats, pilings, docks and telephone poles must be treated to make it water resistant and to protect it from the damaging effects of termites and other insects. A typical wood preserving operation uses any of the following processes to treat and condition raw wood and lumber: steaming boultonizing, kiln or air drying. The principal wood preserving agents used in these processes are phenols such as creosote and pentachlorophenol (PCP) and two compounds that contain heavy metals - chromated copper arsenate (CCA) and ammoniacal copper arsenate (ACA). Of particular concern are power company and telephone company pole treating and storage areas. In the town of Tewksbury, phenols have been found in a well adjacent to such an area.

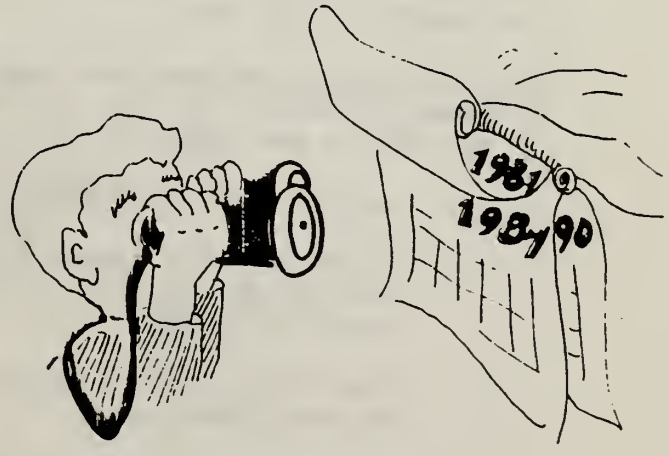
Local Regulatory Techniques

X. LOCAL REGULATORY TECHNIQUES[18]

Methods for Protecting Areas Important to Groundwater Supplies[19]

Each of the local boards discussed in the following section can do something, often a great deal, to protect groundwater supplies. For best results, boards should work together. A good way to begin would be to form a committee with a representative from each board or department and other interested citizen groups. This committee should begin by sorting out jurisdiction so that the agencies will not be working at cross-purposes or exceeding their legal authority.





Every community has different groundwater protection needs. In a growing suburb, low-density aquifer zoning, reduction of road salt on local ways and health board restrictions on underground storage tanks may be appropriate. In rural areas, controlling sand and gravel mining, agricultural chemicals and waste disposal may be more important. Each city or town should determine what the principal sources of trouble may be, which boards can best deal with them, and then develop a groundwater protection program specifically for their community that includes the appropriate protection strategies and a schedule to implement them.

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[18] illustrations in this section are courtesy of the Maine Association of Conservation Commissions, "Watching Our Wastes: A Citizen's Guide to Hazardous Waste in Northern New England," 1983.

[19] adapted from Massachusetts Audubon Society, Groundwater Information Flyer #4, July 1984.



Zone I: The 400 foot radius around a public supply well is protected by state law. Public water suppliers must acquire and protect land designated in this area.

Zone II (primary recharge area) and Zone III (please refer to section on Wellhead Protection for more information): These areas can be protected by appropriate use and enforcement of the following methods.

- o Aquifer protection zoning
- o Strict controls (including prohibition) of underground fuel storage and hazardous materials as part of a nonzoning hazardous materials bylaw.
- o Town bylaws such as hazardous materials, earth removal, wetlands and watershed zoning.
- o Subdivision control regulations.
- o Health Board regulations
- o Use of BMPs for all licenses/permits granted.
- o Good policies and practices for road salt use.
- o Pesticide and fertilizer-use BMPs on town-owned lands in critical groundwater resource areas.
- o Enforcement of Title 5 and local septic system regulations.
- o Land acquisition via outright purchase, long-term lease, conservation restrictions, or agricultural preservation restrictions. Creation of a "greenway" along banks of streams or ponds that supply water via induced infiltration through the use of conservation restrictions or land acquisition.

An example of how these various techniques can be used to control the land use categories discussed in Section IX is presented as the **Land Use/Local Regulatory Techniques Matrix** (please refer to Section XIII). This Matrix complements the **Land Use/Public Supply Well Pollution Potential Matrix** and the Sections IX and X of this handbook and should be used as a handy reference source. Using the Guide and Matrices, municipalities can strengthen and build upon their existing regulatory framework to ensure coverage for the many kinds of contaminant sources.



ZONING

Deriving from the police power vested by the state's constitution, zoning has long been used as a means for communities to manage growth. M.G.L., ch. 40A and its amendment of 1975 (chap.808), which is referred to as the Zoning Act, has specifically included conservation of natural resources among the purposes of zoning. Towns may enact zoning restrictions protecting local groundwaters for the following purposes: to conserve health; to prevent overcrowding of land; to facilitate the adequate provision of water, water supplies, drainage and sewerage; to conserve the value of the land including the conservation of natural resources and the prevention of blight and pollution of the environment. For developed and undeveloped land, a community's zoning bylaws regulate the density of development, the dimensions of lots and buildings and define allowable uses, restrictions, exemptions and uses allowed only by special permit.

Among Massachusetts communities, the most prevalent zoning technique used to protect groundwater supplies is a Groundwater Protection, Water Resource Protection, or Aquifer Protection District bylaw. Commonly, these zoning bylaws are prepared as "overlay districts", areas superimposed on the existing zoning map with a provision that the rules of the underlying district continue except where the overlying district is more stringent. These bylaws are designed to prevent contaminants from getting into the groundwater by regulating activities and land uses which might generate contaminants in the primary recharge area (Zone II) and Zone III areas of public supply wells (see section on Wellhead Protection for more information).

Some communities have adopted bylaws that prohibit certain land uses within specified zones, i.e., Zone II areas, while other communities have opted to permit all uses as long as they meet specified performance standards, e.g., standards for underground storage tanks, storage areas for hazardous materials, contingency plans for spills/leaks of hazardous materials and registration of hazardous materials. For example, Amherst and Bourne list prohibited uses with the remaining uses subject to the zoning in the underlying district. Wilbraham and Fitchburg list permitted uses with specific requirements attached to those uses. Many towns also include a special permit, either for listed uses or in order to receive an exemption from the prohibited uses or added requirements.

The discretion allowed the Special Permit Granting Authority (SPGA) varies from general measures such as ensuring the town's water supply is protected to very specific (and sometimes numerical) measures of discharges and construction specifications. M.G.L., ch. 40A, sect. 9 allows the city or town to designate in its zoning ordinance or bylaw whether the SPGA shall be the planning board, the selectmen/city council or the board of appeals. Many communities believe the planning board is the most appropriate body to administer special permits relating to the protection of groundwater. This is because the board is familiar with the planning function whereas the board of appeals is more accustomed to dealing with hardship variances and selectmen or city councils are often too busy to deal with processing a complex discretionary permit (Mass. Audubon Society, 1984).

Examples of Activities and Uses Regulated by Zoning Bylaws

Many Massachusetts communities with Aquifer Protection or Groundwater Protection District bylaws divide the regulation of various land uses and activities into three categories: Prohibited Uses, Restricted Uses and Uses Allowed by Special Permit. Based upon a review of bylaws adopted throughout the state (files are maintained by the DEQE Division of Water Supply) to protect groundwater resources, the table below is a sample listing of activities often regulated by zoning bylaws.

Frequently Prohibited Uses in High Priority Water Supply Protection Areas

- Trucking or bus terminals
- Gasoline Stations, Motor Vehicle Service and Repair Shops
- Car Washes
- Furniture Stripping
- Wood Preserving
- Motels/Hotels
- Metal Plating
- Chemical Manufacturing
- Solid Waste Landfills and Dumps
- Junkyards and Salvage Yards
- Underground Storage and/or transmission of oil, gasoline or other petroleum products
- Outdoor Storage of Road Salt (NaCl) or other de-icing materials, the application of road salt and the dumping of salt-laden snow
- Outdoor Storage of Pesticides or Herbicides
- Animal Feedlots
- Dry Cleaning establishments
- Laundromat/Laundry establishments
- The use of Septic System Cleaners which contain toxic chemicals (such as methylene chloride and 1,1,1 trichloroethane)
- Businesses and Industrial Uses (excluding agricultural) which involve the on-site disposal of process wastes from operations

Prohibited Uses (continued)

- Disposal of liquid or leachable wastes, except for:
  - * the installation or enlargement of a subsurface waste disposal system for a residential dwelling;
  - * normal agricultural operations;
  - * business or industrial uses which involve the on-site disposal of wastes from personal hygiene and food preparation for residents, patrons and employees.
- Municipal Sewage Treatment facilities with on-site disposal of primary or secondary effluent
- Sand and Gravel extraction
- Boat Service, Repair and Washing establishments
- The rendering impervious of more than 10% of any lot
- Electroplating establishments
- Metal Plating and Finishing establishments
- Beauty Parlors/Hairdressers
- Auto Body Shops
- Photo Processors/Printing establishments
- Chemical/Biological Laboratories
- Parking areas of over 50 spaces

Frequently Restricted Uses in High Priority Water Supply Protection Areas

- Excavation for the removal of earth, sand, gravel and other soils
- Use of Road Salt (NaCl)
- Use of commercial fertilizers, pesticides and herbicides
- Drainage from impermeable surfaces, for example, requiring the installation and maintenance of oil, grease and sediment traps

- o Aboveground storage tanks for oil, gasoline or other petroleum products, for example, requiring tanks to be located within a building or placed on an impermeable surface with dikes/berms to prevent spills or leaks from contaminating the groundwater

- o Lot Size: in areas not served by municipal sewerage systems, towns have established minimum allowable lot sizes, often 40,000 square feet.

Uses Allowed by Special Permit

For those towns issuing special permits for certain uses or as exemptions, criteria for granting special permits generally address the quality and quantity of the water resources. The concerns are both to perpetuate the recharge, thereby maintaining the groundwater yield, and to prevent degradation of the water quality. Those uses allowed by special permit must be in accordance with the regulations specified in the zoning bylaw. The Special Permit Granting Authority (SPGA) issues the special permit after a review of the permit application.

Many communities require an applicant for a special permit to submit the following information:

- o A site plan which shows (but is not limited to):

  - drainage recharge features

  - soil erosion and sedimentation control provisions

  - provisions to control seepage from sewer pipes

  - provisions to prevent contamination of groundwater by petroleum products or hazardous chemicals

- o A complete list of chemicals, pesticides, fuels or other potentially hazardous materials to be used or stored on the premises in quantities greater than those associated with normal household use. A complete list of hazardous wastes to be generated. Applicants using or storing such hazardous materials or generating hazardous wastes must file a definitive operating plan which shows (but is not limited to):

  - provisions for protection of hazardous materials and wastes from vandalism

  - provisions for the prevention of corrosion and leakage of containers storing hazardous materials and wastes

- indoor storage of all hazardous materials and wastes
- impervious floor surfaces with no interior drains
- provisions to prevent hazardous materials/waste spillage to the outside
- provisions for the storage of accumulated waste
- provisions for the immediate containment and clean-up of any hazardous spills
- evidence of compliance with the Regulations of the Massachu setts Hazardous Waste Management Act, 310 CMR 30.000
- evidence of approval by the DEQE of any industrial waste treatment or disposal system or any wastewater treatment system of over 15,000 gallons per day capacity
- for the underground storage of toxic or hazardous materials, evidence of qualified professional supervision of system design and installation.



LOCAL BYLAWS OR ORDINANCES

M.G.L., ch. 40 gives municipalities the authority to pass local bylaws and ordinances they judge to be conducive to the municipalities' welfare. The primary emphasis of a local bylaw is to require certain safeguards for handling and storing materials rather than to regulate land uses. Bylaws and ordinances differ from zoning bylaws in that pre-existing uses can be regulated by a general bylaw while they are protected as non-conforming uses under zoning bylaws (Ch. 40A, sect.6). Furthermore, unlike aquifer protection or groundwater protection zoning districts, a general bylaw applies to the entire town. The Board of Health is generally designated to enforce and/or issue permits.

Communities have adopted general bylaws controlling hazardous and toxic materials such as petroleum products, pesticides and de-icing chemicals. These bylaws contain regulations that prohibit discharges, regulate the storage of hazardous materials, require registration and inventory of hazardous materials and product tight containers. By adopting a general bylaw to regulate toxic and hazardous materials, a community can regulate many of the small businesses and industries not covered by a zoning bylaw. For example, a general bylaw establishes specific requirements on a town-wide basis including:

- existing and proposed commercial and industrial businesses that have underground storage of hazarous materials and fuel must obtain a permit from the Board of Health
- design, construction and installation requirements for all new and replacement underground storage tanks
- periodic testing of underground storage tanks using specific pressure testing procedures
- provisions for inventory control and response to leaks
- development of a spill control and countermeasure plan
- registration of toxic and hazarous materials
- requirements for the aboveground storage of hazardous materials
- requirements for areas where hazardous materials are pumped or transferred
- guidelines for air emissions of solvents
- guidelines for the installation of underground storage tanks in proximity to water supplies

SUBDIVISION REGULATIONS

Another means of managing groundwater supplies available to Massachusetts' communities is through subdivision regulations established under M.G.L., ch. 41, sect. 81m. A subdivision is defined as any tract of land being divided into two or more lots which do not front on a public way. This definition applies where an access to two or more lots must be provided for the development. Subdivision control is a means to protect the safety, convenience, and welfare of the town's inhabitants by requiring adequate provision for water, sewage, drainage, and underground utility storage in all subdivision developments, and to ensure compliance of plans with applicable bylaws and board of health regulations.

When reviewing the design of a proposed subdivision, the planning board should consider the potential effects of the development on groundwater. Commonly used protective measures include appropriate design and construction standards for roads, drainage works and utilities such as:

- Roads should be designed for winter safety to reduce road salt usage to a minimum.
- The widths of roads should be minimized to lessen the extent of impervious surfaces.
- Unnecessary paving and disturbance of soils over groundwater recharge areas should be avoided.
- Natural vegetation should be retained wherever possible. Vegetation reduces the erosion potential by increasing the infiltration of rainfall into the soil.
- Runoff from the site should not be increased due to development.

Subdivision regulations do not provide as extensive control as zoning because they are limited to only those activities associated with the subdivision of land. However, the board of health is required to review all subdivision plans; this ensures greater oversight of proposed activities.

BOARDS OF HEALTH

Local Boards of Health, charged with the protection of the public health, have the authority to develop, implement and enforce health policies. Every town must elect a three-person health board or the town selectmen may act as this body. Health boards have been given a broad grant of authority under Mass. Gen. Laws, Ch. 111, sect. 31 to adopt "reasonable health regulations" in many areas of environmental health including removal, transportation and disposal of refuse, nuisance, house drainage and sewer connections, offensive trades and the installation of septic systems. Boards may require a permit or establish substantive performance standards for certain activities or set a fee as part of a regulation. Pursuant to a town bylaw, health boards may also be authorized to require permits or set fees for certain activities.

Powers of the Board of Health[20]

- o can hire an agent to enforce state and local laws and regulations.
- o can adopt regulations for any activity that might contaminate groundwater.
- o can regulate local use, transport, and storage of hazardous materials, including fuel (in cooperation with the fire department).
- o administers Title 5 (Environmental Health Code) governing installation and maintenance of septic systems.
- o must approve plans for drainage in subdivision plans, can disapprove a subdivision plan or portion of a plan because of a threat to groundwater quality.
- o has broad power to regulate "nuisances," including those that threaten groundwater quality.
- o must assign sites for "offensive trades," landfills, garbage dumps, and hazardous waste disposal.

Health Boards adopt regulations by a majority vote and publication of the regulations once in a local newspaper. In order to protect groundwater quality, health boards have voted to increase setback requirements for septic systems. For example, boards have required a 100 foot buffer along all streams and other watercourses and a 200 foot or more buffer around reservoirs and lakes. Boards have also increased the distance between the maximum groundwater elevation and the bottom of the leaching

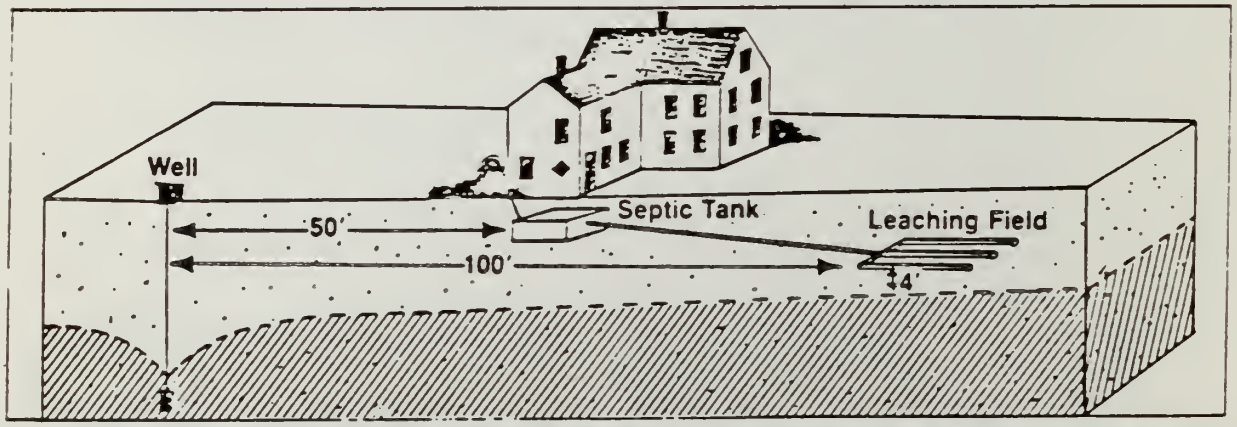
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[20] adapted from Massachusetts Audubon Society, Groundwater Information Flyer #4, July 1984.

field from 4 to 8 feet over aquifers. Health boards have established maximum percolation rates, more stringent septic system design requirements and limited the determination of maximum groundwater elevations to the "wettest" months or weeks of the year (MAPC, 1982).

Authority to Regulate Specific Activities

Subsurface sewage disposal systems: Massachusetts General Laws (M.G.L.), ch. 21A, sect. 13 and Title 5 of the State Environmental Health Code (found in 310 CMR 15.00) establish minimum standards for the location, design, construction and maintenance of septic systems and leaching fields for subsurface disposal of wastes in unsewered areas. Title 5 includes minimum setback requirements for septic tanks and leaching fields. The minimum distances between leaching fields and wells or other drinking water supplies is 100 feet and the minimum distance between septic tanks and wells or other drinking water supplies is 50 feet. In addition, Title 5 states that the leaching field must be at least four feet above the seasonal high water table elevation. When local conditions such as topography and types of soils warrant higher standards, boards of health may adopt more stringent regulations to ensure the septic system functions properly and to prevent groundwater or surface water contamination.



One important health board responsibility is to enforce regulations for the design, location, and construction of septic systems that must meet these minimum state requirements for distance from wells and the maximum water table level. Health boards can adopt stricter regulations if local conditions warrant them.

SOURCE: Mass. Audubon Society, Groundwater Information Flyer #4, July 1984.

Local boards are responsible for issuing permits for the construction of septic systems. However, DEQE must approve all plans for systems with flows over 15,000 gallons per day. In addition, DEQE regulates all disposal of industrial wastewater. Before a construction work permit may be issued, a representative of the health board must visit the site and inspect the deep observation pit and observe the percolation tests. The percolation test is used to determine the suitability of the soil at the leaching elevation and the suitability of the soil 4 feet below this elevation. In order to examine the soil, determine the maximum groundwater elevation and presence of bedrock or impermeable material, a deep observation hole is excavated at the site.

Title 5 states that the leaching field must be at least four feet above the maximum high groundwater elevation (water table). This standard is important for groundwater protection since the contaminants form a leaching system that is located at or below the water table will enter groundwater directly without the benefit of filtering through the soil. Unfortunately, careful enforcement of this standard will not guarantee a community unpolluted groundwater. The density of septic systems and the permeability of the soil have an important role in determining whether groundwater becomes polluted. Title 5 bans the installation of a septic system in soils that have a slow percolation rate.

Any of the following four factors determine whether or not a septic system will function properly: depth to seasonal high water table, soil type, surficial deposits and maintenance of the system. Septic systems located in areas with a high seasonal water table will fail due to flooding of the leaching field. In areas characterized by impermeable soils and surficial materials (percolation rates >30 minutes per inch), sewage effluent will not readily infiltrate the ground and may instead emerge at the land surface and contaminate surface water supplies. Areas of coarse, well sorted sands and gravels that have a rapid percolation rate will not adequately treat the sewage effluent and local groundwater contamination may occur. Finally, a properly located system must be conscientiously maintained and utilized. Septage should be removed from the septic tank on a regular basis. **Household hazardous wastes such as paint thinner, motor oil, varnishes, acids, etc. should not be disposed of in the septic system.**

Septic system maintenance: It is the responsibility of the septic system owner to properly maintain their system. The Board of Health has the authority to require periodic inspection and pumping of every septic system in the community. If necessary, the board can order a system to be cleaned or repaired and require all expenses incurred to be paid by the owner. Septic tanks must be accessible for service and cleaning and must be inspected or cleaned at least once a year 310 C.M.R. Sect. 15.06 (13), (16). If the health board determines that a septic system is a threat to groundwater quality and the lot abuts a public sewer line, the board has the authority (M.G.L., ch. 83, sect. 3) to require the landowner to connect to the sewer at his or her own expense. Furthermore, the sewer commissioners cannot substitute their judgement on this matter (Mass. Audubon Society, 1984).

Garbage, Rubbish and Landfills: Mass. Gen. Laws, Ch. 111, sect. 150A gives the board of health the authority to regulate the location of dumps, landfills, disposal sites, residual waste treatment plants, recycling facilities and refuse transfer stations. Health boards control these activities through the issuance of site assignments. The site assignment process considers the extent, character and nature of the operation so as to protect the public health. Boards must apply the standard set forth in Mass. Gen. Laws, Ch. 111, sect. 150B when approving or disapproving a site assignment. Unfortunately, the application of this standard is unclear. Health boards are directed to evaluate the facility on the basis of whether or not it poses a significantly greater danger to the public than the danger that currently exists in the operation of a facility that uses comparable processes. This statute does not give health boards the necessary guidance for determining comparable processes or degree of danger. However, recent solid waste legislation, passed on December 17, 1987, authorized DEQE to promulgate new site assignment criteria by April 15, 1988.

All site assignments must be approved by the DEQE, which discourages the location of landfills in watersheds of drinking water supplies. Furthermore, state landfill regulations (310 CMR 19.00) prohibit landfills in wetlands and floodplains and require a minimum of four feet between the bottom of the refuse and the groundwater during periods of maximum high water table elevation. These regulations are not sufficient to protect groundwater from contamination by landfill leachate. **Although recent legislation requires that most new landfills be equipped with liners and leachate collection systems, local boards of health should not allow landfills to be located over aquifers or recharge areas.** The health board should also monitor the operation of existing landfills in their towns to prevent the disposal of hazardous materials such as pesticides, and toxic chemicals from homes, stores and industries.

Subdivision Control: Under M.G.L., ch. 41, sects. 81K - et seq., local boards of health have an important role in subdivision control. They can approve or disapprove subdivision plans based upon any subject that is within their realm of authority including drainage, sewer lines, on-site sewage disposal, potential contamination of municipal wellfields as well as other areas subject to board of health review. Furthermore, unlike planning boards which are limited by the rules and regulations adopted under section 81Q of the Subdivision Control Act, health boards enjoy a broad scope of jurisdiction and authority. For example, if the board of health disapproves a subdivision plan because it determines that groundwater pollution is likely to occur, the planning board may not approve the plan. If, on the other hand, the board of health approves the plan, the planning board may only disapprove if the board has established water pollution regulations and if the plan violates these regulations. If the health board disapproves a subdivision plan it must indicate in its report any unsuitable building lots and the reasons for determining the lot(s) unsuitable. When possible, the board should also submit recommendations for making the plan acceptable. Or, the board may issue a conditional approval. Failure to meet the board's conditions would result in an automatic rescission of the board's approval.

Hazardous Waste: Under M.G.L., ch. 111, sect. 150B, health boards also have the responsibility to assign areas for the disposal of hazardous wastes. This law governs new disposal sites as well as existing generators who store, process, or dispose of hazardous wastes produced onsite. Although a community may not ban all disposal of hazardous wastes within its boundaries (this power was taken over by the state under M.G.L., chs. 21C and 21D), it can exercise its significant power over industrial and commercial use of hazardous materials. Many communities have subsequently adopted home rule registration. systems for all activities that involve hazardous materials and are requiring that generators and users to inform the health board how they use, store, and dispose of listed chemicals.

Underground Storage of Fuels and Chemicals: The underground storage of petroleum products and hazardous materials is a major concern to a number of Massachusetts communities. Leaking storage tanks can contaminate large volumes of groundwater. Perhaps the most well-known example of groundwater contamination from leaking a underground storage tank is Provincetown's South Hollow wellfield (located in neighboring Truro). It took ten years and $3.3 million dollars to rid the groundwater of gasoline. The wellfield was put back on-line in 1986.

Regulations designed to prevent groundwater contamination by leaking underground storage tanks have been adopted by several communities under the authority granted by M.G.L., ch.111, sect. 31(8). In addition, boards have adopted toxic and hazardous materials regulations that control the storage and disposal of fertilizers, pesticides, herbicides, and road salts.

Nuisance: Under M.G.L., ch. 111, sect. 122, health boards are authorized to examine all nuisances which, in the board's opinion, may be injurious to the public health including those that threaten groundwater quality. Once an activity is declared a nuisance, the board will order the nuisance removed within 24 hours at the owner's expense. The board may abate the nuisance by hiring a person or firm under contract if the owner fails to comply with the board's order. Expenses incurred by the health board may be recovered from the owner in a subsequent court action.

Thus, the mandates of the Board of Health provide many methods for the protection of the public health and the environment from groundwater contamination. Septic systems, landfills, hazardous materials and other polluting and potentially dangerous wastes can be properly managed under existing authorities by the Board of Health.

Planning Boards[21]

Over 70 years ago, planning boards were created by Massachusetts General Laws, ch. 41, to plan for the "resources, possibilities, and needs" of their communities, including the protection of natural resources. Generally, planning boards contain from five to nine members, who are appointed by the mayor or city council in cities and appointed by the selectmen or elected by the voters in towns.

Powers of the Planning Board

- o can plan for the "resources, possibilities, and needs" of the community, including groundwater protection; can develop a master plan and conduct other planning studies, including water-supply plans.
- o can serve as the special permit granting authority within zoning districts.
- o can develop and propose an official map governing the layout of roads and parks. (Protection of groundwater can be considered as the map is developed.)
- o must adopt regulations for reviewing subdivision plans and can include groundwter protection measures related to drainage, public ways, and public safety; can require extensive information about a proposed subdivision, including information about groundwater; may require construction bonds to ensure that drainage work is done properly.
- o must review all proposed zoning bylaws and amendments; can develop and recommend zoning and non-zoning provisions including site-plan review bylaws, and environmental performance standards to control design of projects not covered by subdivision control.

Subdivision Control Powers of the Planning Board

In order to provide for public safety, adequate roadways, water, sewage, drainage and other services, M.G.L., ch. 41, sects. 81K-81GG, requires anyone planning to subdivide land so that the new lots do not have frontage on a way deemed adequate by the planning board to submit plans to the planning board and also to the board of health.

All of the powers of review exercised by a planning board under the subdivision control law depend upon, and are limited by, the regulations adopted by that board. Thus, if a planning board wishes to protect groundwater in subdivisions, it must adopt detailed subdivision regulations that include specific standards for groundwater protection. The board should consult model

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[21] adapted from Massachusetts Audubon Society, Groundwater Information Flyer #4, July 1984.

subdivision regulations such as the one developed by the Metropolitan Area Planning Council (see Appendix). Model subdivision regulations contain provisions for maximizing groundwater recharge through the use of swales or other alternative drainage designs, limiting pavement over aquifer recharge areas, and preventing pollution from runoff by requiring the installation of erosion and sediment control devices or oil traps in catch basins.

The Supreme Judicial Court has held that, because of its overall planning function, a planning board may require extensive information about a proposed subdivision even if this information is not directly relevant to ways or utilities. For example, applicants may be required to submit data on soils and runoff. The power to deny a proposed subdivision plan, or to regulate its impact on the rest of the community is, however, strictly limited by the subdivision control law. **The board must be able to point to a particular regulation with which the proposed subdivision plan does not comply.** The Court has also held that subdivision regulations must contain explicit standards so that the developer will know what information the board expects to receive and review. A provision that runoff from the subdivision should not exceed that of pre-existing conditions would be adequately clear; a mandate to preserve groundwater recharge might be too vague.





CONSERVATION COMMISSIONS

The Massachusetts Wetlands Protection Act (WPA), M.G.L., ch. 131, sect. 40, is probably the best known environmental law in the Commonwealth and serves as a model statute for wetlands protection among the states. Since 1972, conservation commissions have had primary jurisdiction over activities within 100 feet of inland wetlands, coastal wetlands and areas within the 100 year floodplain. Almost every town in the Commonwealth has a conservation commission. In the absence of a commission, the selectmen or mayor exercise this authority.

Powers of Conservation Commissions[22]

- can acquire conservation lands (with the approval of chief elected officials [CEOs]) including aquifers and recharge areas; can apply for state and federal funding for land acquisition (with CEO approval).
- can purchase or acquire by gift conservation restrictions on land important for groundwater protection (approval of CEOs and the Executive Office of Environmental Affairs required); can also hold agricultural preservation restrictions
- may receive gifts of land and money (CEOs' approval necessary).
- may establish regulations for use of land under its control; can include measures to protect groundwater.
- has jurisdiction under the Massachusetts Wetlands Protection Act over activities in wetlands and floodplains that could pollute groundwater.
- can develop local bylaws to provide additional protection to wetlands (and the groundwater associated with them); bylaws must be passed by town meeting or city council.
- may serve as the permit agency for earth removal applications.
- can provide environmental education activities to the public.

Wetland areas include wet meadows, marshes, swamps, bogs and areas where groundwater flowing or standing provides an environment for a plant community for at least five months of the year. Those plants or plant groups which are determinants of a wetland (indicator plants) are named specifically in the WPA. Water supply and groundwater are two of the seven recognized wetland values named in the WPA that conservation commissions can reference in their actions. Often, wetlands serve as a groundwater discharge and/or recharge area depending upon the geologic conditions and the time of the year.

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[22] adapted from Massachusetts Audubon Society, Groundwater Information Flyer #4, July 1984.

Wetlands can be very valuable as a biological system for treating and attenuating some contaminants. Certain biologically degradable contaminants when discharged upgradient from wetland areas have been broken-down as they pass through wetlands. In addition, the presence of organic matter, clay and silt in wetlands can aid in the attenuation of heavy metals.

The proponents of any project within 100 feet of a wetland or one which will result in the alteration of a wetland must obtain an "Order of Conditions" from the local conservation commission. This permit specifies performance standards that must be met or denies the project in the submitted form. Typical orders of conditions contain restrictions on the use of chemicals, petroleum, manure, and other sources of pollution, storage and application of road salt, fuel storage tanks and standards for septic systems and excavation below the water table. Standards can be set to limit paving and require erosion controls, including the use of hay bales and oil and grease traps.

Over 40 towns and cities have adopted local versions of the Wetlands Protection Act (nonzoning bylaws enacted under M.G.L., ch. 40, sect. 21). These local wetlands bylaws are administered by conservation commissions in connection with the administration of the state law. The advantages of a local wetlands protection bylaw include the right to add values not covered by state law, such as protection of wildlife habitat; optional exclusion of exemptions found in the state WPA, such as the exemption for agriculture, whcih also covers use of pesticides, fertilizers and herbicides and the absence of a DEQE override [decisions are appealed only to a court] (Mass. Audubon Society, 1984). After the completion of a hydrogeologic study to define the recharge areas to its public supply wells and delineate the boundaries of its aquifers, many town conservation commissions have used their authority under the WPA and local wetlands bylaw to manage activities in aquifer recharge areas in or adjacent to wetlands.

XI. GLOSSARY[23]

Aquifer. A formation, group of formations, or part of a formation that contains sufficient saturated, permeable material to yield significant quantities of water to wells and springs.

Artesian. see **Groundwater, confined.**

Best Management Practices (BMPs). Methods, measures, or practices to prevent or reduce groundwater and surface water pollution, including, but not limited to, structural and nonstructural controls and operation and maintenance procedures. BMPs may be applied before, during or after pollution-producing activities to reduce or eliminate the introduction of pollutants into groundwater and surface waters.

Buffer Strip. Strips of grass or other erosion-resistant vegetation between a waterway or sensitive aquifer recharge area and an area of more intensive land use.

Cone of Depression (or Drawdown cone). A roughly conical concavity (or dimple) in the potentiometric surface around a pumping well.

Confining Bed. A body of "impermeable" material stratigraphically adjacent to one or more aquifers. Synonyms: aquitard, aquiclude; and aquifuge.

Conservation Tillage (Reduced Tillage). Farming practices, such as reduced plowing, that cause less disruption of the land surface than does conventional tillage. Common practices include plow planting, double-disking, chisel-plowing, and strip tillage.

Contour Strip Cropping. Farming operations performed on the contour with crops planted in narrow strips, alternating between row crops and close-growning forage crops.

Diffusion. The process by which dissolved substances move from a region of higher concentration to a region of lower concentration.

Dispersion. The act of spreading or distributing a dissolved substance from a fixed or constant source; or the process by which a dissolved substance spreads out from a constant or fixed source.

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[23] adapted from U.S. Geological Survey Water Supply Paper 1988.

Erosion. The wearing away of a land surface by wind or water. Erosion occurs naturally from weathering or runoff but can be intensified by land clearing practices.

Grassed Waterway. A natural or constructed waterway (usually broad and shallow, covered with erosion-resistant grass) that is used to conduct surface water from cropland.

Groundwater, confined. Groundwater that is under pressure significantly greater than atmospheric pressure, and its upper limit is the bottom of a bed of distinctly lower hydraulic conductivitiy than that of the material in which the confined water occurs.

Groundwater, perched. Unconfined groundwater separated from an underlying body of groundwater by an unsaturated zone. Its water table is a **perched water table.**

Groundwater, unconfined. Water in an aquifer that has a water table.

Groundwater Divide. A vertical, imagineary, impermeable boundary that, in an ideal, symmetrical groundwater system, coincides exactly with the topographic highs that represent surface water divides from which water flows in opposite directions.

Homogeneity. The quality or state of having uniform structure or composition; in hydrology, this term describes an ideal fluid.

Hydrologic Cycle. The continuous circulation of water between the ocean, atmosphere and the land.

Infiltration. The entry into the soil of water made available at the ground surface, together with the associated flow away from the ground surface within the unsaturated zone.

Integrated Pest Management. Combing the best of all useful techniques; biological, chemical, cultural, physical and mechanical, into a custom-made pest control system.

Isotropy. That condition in which all significant properties are independent of direction.

Leachate. The liquid derived from the leaching of buried refuse in sanitary landfills and dumps by percolating water derived from rain or snowmelt. It frequently contains large numbers of inorganic contaminants and high values for total dissolved solids, and may contain many organic contaminants.

Perched Water Table. The occurence of a discontinuous saturated zone with an unsaturated zone above and below. This condition is commonly caused by layered geologic materilas with differing permeabilities.

Percolate. Water moving by gravity through pore spaces of unsaturated geologic material.

Permeability. The capacity of a porous medium for transmitting water.

Plume. A relatively discrete body of contaminated groundwater originating from a specified source(s) and influenced in its movement by such factors as the local groundwater flow pattern, the specific gravity and solubiltiy of the contaminant, the subsurface geology within the zone of saturation and the influence of pumping wells.

Porosity. The ratio of the volume of small openings in soil or rock to its total volume; it is usually expressed as a percentage.

Potentiometric Surface. A surface that represents the static head. In an aquifer, it is defined by the levels to which water will rise in tightly cased wells. The water table is a particular potentiometric surface.

Recharge. The entry into the saturated zone of water made available at the water table surface, together with the associated flow away from the water table within the saturated zone.

Recharge Area. That portion of a drainage basin in which the net saturated flow of groundwater is directed away from the water table.

Runoff. 1. That portion of precipitation that does not return to the atmosphere through evapotranspiration nor infiltrate the soil to recharge groundwater but leaves the hydrologic system as streamflow. 2. That portion of precipitation delivered to streams as overland flow to tributary channels.

Saturated Zone. The subsurface zone occurring below the water table where the soil pores are filled with water and the moisture content equals the porosity.

Terraces. Embankments built along the contour of agricultural land to hold or divert runoff and sediment, thus reducing erosion.

Tillage. Plowing, seedbed preparation, and cultivation practices.

Unconfined Aquifer. An aquifer having a water table.

Unsaturated Zone. the subsurface zone occurring above the water table where the soil pores are only partially filled with water, and the moisture content is less than the porosity.

Water Table. The surface on which the fluid pressure in the pores of a porous medium is equal to the atmospheric pressure. It is the level at which water stands in a shallow well open along its length and penetrating the surficial deposits just deeply enough to encounter standing water in the bottom.

Watershed. The area of contribution to a surface water body. It is defined by topographic high points.

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XIII. MATRICES

Land Use/Public Supply Well Pollution Potental Matrix
Land Use/Local Regulatory Techniques Matrix

Appendices

APPENDIX A

Technical References for Protecting Groundwater from Hazardous Materials and Other Contaminants

TECHNICAL REFERENCES FOR PROTECTING GROUNDWATER FROM HAZARDOUS MATERIALS AND OTHER CONTAMINANTS

prepared by:
New England Interstate Water Pollution Control Commission
85 Merrimac Street
Boston, Massachusetts 02114
(August,1988)

pg. no. LIST OF CONTENTS:

TR-1 Inventory of GW Pollution Sources
2 Local Administrative and Management Controls
3 Sources for Hazardous Material Bylaws
3 Risk Assessment Methods
4 Non-Point Source Pollution(General)
5 Road Salting/Storage
6 Urban Runoff/Stormwater Management
6 Lawn Care and Agriculture
7 Storage of Hazardous Materials
8 Underground Storage Tanks
9 Source Reduction/Waste Minimization
10 Waste Oil
10 On-site Disposal Systems
11 Household Hazardous Waste Collection
11 Emergency Planning and Community Right-to-Know
12 Training and Educational Programs

[E]= EPA Region I Library, JFK Federal Bldg., Boston, MA 02203
Tel: 617-565-3300
[N]= NEIWPCC Library, 85 Merrimac Street, Boston, MA 02114
Tel: 617-367-8522

INVENTORY OF GW POLLUTION SOURCES:

Local Groundwater Protection, 1987, 236 pp.. From: American Planning Association, 1313 E. 60th Street, Chicago, IL 60637. tel:312-955-9100. Price: $39.95+ $3 postage. A comprehensive look at groundwater resources and threats; guidelines for planning and implementing a local groundwater protection program. Examples of local source control and aquifer protection ordinances. Illustrations.[N]

Protecting Connecticut's Groundwater: A Guide to Groundwater Protection for Local Officials, 1984-currently under revision, 90+ pp.. From: Connecticut Department of Environmental Protection, 122 Washington Street, Hartford, CT, 06115. tel: 203-566-7049. Price: $5 + 2.00 payable to DEP Publications. Guidebook identifying types of groundwater pollution, recommendations for local community protection programs, model ordinances and permits, and technical guidelines for selected commercial operations (dry cleaning, photographic processing, auto services, furniture stripping, and machine shops).[N]

Groundwater Quality: A Handbook for Community Action, 1985, 29+ pp.. From: Maine Association of Conservation Commissions, P.O. Box 831, Yarmouth, Maine 04096. tel:207-846-3329. Price: $4 prepaid to MACC. Guidelines for organizing and conducting an inventory of historic land uses whose past activities may pose a threat to groundwater supplies. Applicable in any New England state.[N]

Elements of a Comprehensive Investigation to Identify Past Hazardous Waste Releases, 35+ pp.. From: Resource Education Institute, P.O. Box 92, Northborough, MA 01532. tel: 617-393-8542. Price: $10.50 includes postage. Excerpts from a course on site assessment and monitoring previous land uses for hazardous wastes. Intended for use in real estate.

Overview of Sources of Contamination in Well Head Protection Areas, technical guidance document in progress. For information on availability, contact EPA Region 1, Groundwater Section, JFK Building, Boston, MA 02203. tel:617-565-3600.

Current projects in the New England States concerning land use and pollution source inventories in well head protection areas:

The Chesprocott Health District Aquifer Management Project, Chesprocott Health District, Connecticut, tel: 203-272-2761. A pilot project to organize a geographic information system, establish a groundwater protection strategy, and inventory potential sources of contamination.
Wellhead Protection Program Pilot Study, Maine Dept. of Human Services, tel:207-289-5681. A pilot study to assess the feasibility of Wellhead Protection Area delineation methods and contaminant source identification methods.
UIC Inventory and Education Project, Rhode Island, Division of Groundwater, tel: 401-277-2234. Pilot project to identify and define the number and types of activities that threaten groundwater resources; primary focus on Class V injection wells.
UIC/WHPA Pilot Study, Vermont Dept. of Health, tel: 802-863-7326. Program includes an inventory of land uses within project area and development of a risk assessment methodology.
Priority Groundwater Resource-Based Mapping Project, EPA Region 1, tel: 617-565-3615. Pilot studies in New Hampshire and Rhode Island to show the geographic relationship between important groundwater resources and contaminant sources; also, land use in existing and potential wellhead areas.
WHP Pilot Project, Hew Hampshire, Groundwater Protection Bureau, tel: 603-271-2755. Town of Merrimac has been chosen as pilot study.

LOCAL ADMINISTRATIVE AND MANAGEMENT OPTIONS:

Administrative and Legal Options for Storing Hazardous Substances,1984, 28 pp.. From: Health Education Services, P.O. Box 7126, Albany, New York 12224. tel: 518-439-7286. Price: $3+postage. A guide for local officials outlining administrative controls available to them- codes, land use controls, bylaws, permits, etc.; model local law for hazardous substances storage.[N]

Local Groundwater Protection, 1987, 236 pp.. From: American Planning Association, 1313 E. 60th Street, Chicago, IL 60637. tel:312-955-9100. Price: $39.95+ $3 postage. A comprehensive look at groundwater resources and threats; guidelines for planning and implementing a local groundwater protection program. Examples of local source control and aquifer protection ordinances. Illustrations.[N]

Groundwater Supply Source Protection: A Guide for Localities in Upstate New York, 1987, 43 pp.. From: The Schenectady County Planning Department, 620 State Street, Schenectady, N.Y. 12307. tel: 518-382-3286. Presents background information on groundwater resources and sources of contamination, then discusses development of a local program and implementation techniques such as local laws, land use planning and other regulatory controls.[N]

Summary of Municipal Actions for Groundwater Protection, 1988, 30 pp.. From: New England Interstate Water Pollution Control Commission, 85 Merrimac Street, Boston, MA 02114. tel: 617-367-8522. Price: $1.50. An overview of local actions addressing existing and potential threats to groundwater in New England and New York.[N]

Groundwater Protection: A Guide for Communities, 1982, 121 pp. #WQ/82-05. From: Metropolitan Area Planning Council, 110 Tremont Street, Boston, MA 02108. tel: 617-451-2770. Price: $8.50+ postage. Guide to local and intermunicipal groundwater planning.

SOURCES FOR HAZARDOUS MATERIALS BYLAWS

The following organizations can provide examples of local bylaws and ordinances regarding toxic and hazardous materials:

Connecticut:
Department of Environmental Protection- 203-566-7049
Maine:
Office of State Planning- 207-289-3261
Massachusetts:
Conservation Law Foundation of New England- 617-742-2540
Cape Cod Planning and Economic Developement Commission- 617-362-2511
Department of Environmental Quality Engineering- 617-292-5931
Metropolitan Area Planning Council- 617-451-2770
New Hampshire:
Office of State Planning- 603-271-2066
Nashua Regional Planning Commission- 603-883-0366
New York:
Suffolk County Health Services- 516-451-4634
Center for Environmental Research, Cornell University- 607-255-5943
Association of Regional Planning Organizations- 716-837-2035
Rhode Island:
Rhode Island Cooperative Extension- 401-792-2495
Rhode Island Division of Planning- 401-277-2656
Vermont:
Department of Environmental Health- 802-863-7234

RISK ASSESSMENT METHODS:

"Evaluation Procedure for Groundwater Contamination Potential", Siting Manual for Storing Hazardous Substances, 1984, Appendix E, pp. 81-95, From: Health Education Services, P.O. Box 7126, Albany, New York, 12224. tel:518-439-7286. Price: $10 + 1.75. Describes the 8-step LeGrand methodology to evaluate the overall suitability of a site for storing hazardous materials. Procedure combines site specific hydrogeologic information and a hazard rating of the substance to be stored to arrive at an Overall Confidence Rating.[N][E]

A Pollution Nature Sampling Plan for Groundwater Contamination, 1980, 160 pp.. From: West Michigan Shoreline Regional Development Commission, 137 Muskegon Mall, Muskegon, Michigan 49440. tel: 616-722-7878. Price: $22.75 prepaid. Presents a "fast track" procedure, designed for use by a non-expert evaluator, to determine the hazard potential of a site. Assigns values based upon readlily available information- industrial SIC codes, types of hazardous materials, and proximity to households and water supply.

"A Groundwater Potential Pollution Risk Index System", Groundwater Protection Principles for Rock County, 1985, Appendix B, From: Rock County Health Department, Box 1143, Janesville, Wisconsin 53547. tel:608-755-2642. Price: $6. A groundwater threat ranking methodology to assess the community resource as a whole. Assigns a Risk Factor to potential sources of pollution and also considers the cummulative effects of individual sources to arrive at a community pollution risk index. Parameters are unique to Rock County, but can be adapted to fit any community or project area.[N]

DRASTIC- A Standardized System for Evaluating Groundwater Pollution Potential Using Hydrologic Settings, 1985, 455 pp.. From: National Well Water Association, P.O. Box 182039, Dep't. 017, Columbus, OH 43218. tel:614-761-1711. Price: $69. Weighting system and mapping process that combines seven hydrogeologic factors into a score that serves as an indicator of groundwater contamination potential for any given region of the country.[E]

NON-POINT SOURCE POLLUTION (GENERAL):

Management Recommendations for NPS Pollution Control are available from the following state agencies:

Connecticut, Department of Environmental Protection, 203-566-2588
Maine, Department of Environmental Protection, 207-289-7773
Massachusetts, Department of Environmental Quality Engineering, 617-366-9181
New Hampshire, Department of Environmental Services, 603-271-3398
New York, Department of Environmental Conservation, 518-457-6781
Rhode Island, Department of Environmental Management, 401-277-3434
Vermont, Department of Environmental Conservation, 802-244-6951

Guide to Nonpoint Source Pollution Control, 1987, 121 pp.. From: National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. tel: 703-487-4650 for ordering. U.S.EPA document; Includes sections on Best Management Practices for controlling NPS pollution from agriculture, urban runoff and construction, silviculture and mining; illustrations.[N][E]

Ready Reference Guide to Non Point Source Pollution, 1988, 35+ pp.. From: U.S. EPA, Region I, Water Quality Division, JFK Building, Boston, MA 02203. Prepared for the New England states; provides an overview of NPS pollutants, BMP's and control methods.[N]

Nonpoint Source Management Handbook, 1984, 200+ pp.. From: Long Island Regional Planning Board, Dennison Building, Vets Memorial Highway, Hauppauge, New York 11787. tel: 516-360-5189. Recommendations for nonpoint source pollution controls, guidelines for siting and site plan review, and model ordinances; illustrations. Ring binder format with separate chapters on fertilizers, on-site disposal systems, stormwater runoff, etc.[N]

Assessment of Groundwater Contamination by Nitrogen and Synthetic Organics in Two Water Districts in Nassau County, N.Y.,1985, 52+ pp.. From: Documents Officer, Water Resources Institute, 468 Hollister Hall, Cornell University, Ithaca, N.Y. 14853. tel: 607-255-7535. Price: $3.50 payable to Cornell University. Although specific to Nassau County, provides information and recommendations on land uses such as golf courses, residential land, and users of organic chemicals which pose a threat to groundwater.[N]

A Mass-Balance Nitrate Model for Predicting Effects of Land Use on Groundwater Quality in Municipal Wellhead Protection Areas, 1988, 25+ pp.. From: National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. tel: 703-487-4650 for ordering. A Cape Cod Aquifer Management Project document; provides managers with an easily understood methodology and the relevant associated data for application of this formula.[N]

ROAD SALTING/ STORAGE:

Highway Salt Management Handbook for Local Government Officials, 1988, 40 pp.. From: Cornell Cooperative Extension Regional Office, 146 State Street, Albany, New York 12207. Provides practical information concerning the handling and storage of salt for highway application, including siting considerations for storage areas, structural designs of storage facilities, and handling procedures. Includes a section on current legal aspects in New York state regarding liability at the local government level.[N][E]

Road Salt and Groundwater Protection, 1987, 18 pp.. From: Massachusetts Audubon Society, Educational Resources, South Great Road, Lincoln, Massachusetts 01773. tel: 617-259-9500. Price: $1.50 includes postage. Booklet; describes problems related to the use of road salt and suggests methods for reducing salt use. Provides information on Massachusetts' programs and rates of salt application, and suggestions for local action.[N]

The Road Salt Management Handbook,1986, 47 pp.. From: Pioneer Valley Planning Commission, 26 Central Street, West Springfield, MA 01089. tel: 413-781-6045. Examines a road salt management strategy used in Massachusetts. Outlines steps necessary for developing a local or regional road salt policy. Provides information on implementing Best Management Practices and their implications upon cost and public safety.[N]

URBAN RUNOFF/ STORMWATER MANAGEMENT:

Runoff and Recharge, 1984, 70pp.. #WQ/84-15. From: Metropolitan Area Planning Council, 110 Tremont Street, Boston, MA 02108. tel: 617-451-2770. Price: $8.50+1.25 postage. Aimed at local officials, this guidebook outlines the sources of runoff contamination, and provides alternative drainage designs and methods for pollutant source control, runoff storage, recharge, and stormwater treatment.[N]

Controlling Urban Runoff, 1987, 290 pp.. From: The Information Center, Metropolitan Washington Council of Governments, 1875 Eye Street, N.W., Suite 200, Washington, D.C. 20006. tel: 202-223-6800. Price: $40+ 2.00 payable to MWCOG. A practical guide for local officials, planners, consulting engineers, and developers concerning the use of urban best management practices to maximize pollutant removal, minimize construction costs, and reduce future maintenance burdens.

Recommendations of the Stormwater Management and Erosion Control Committee Regarding the Development and Implementation of Technical Guidelines for Stormwater Management, 1988, 80+ pp.. From: Rhode Island Department of Environmental Management, Office of Environmental Coordination, 83 Park Street, Providence, RI 02903. tel: 401-277-3434. Design guidelines and technical recommendations with supporting explanations.

Stormwater Runoff, 1984, 55 pp.. in **Nonpoint Source Management Handbook**, From: Long Island Regional Planning Board, Hauppauge, New York 11787. tel: 516-360-5189. Provides recommendations for administrative measures, site planning and development and structural and nonstructural stormwater control measures. Describes the existing stormwater systems, problems, and management on Long Island.[N]

LAWN CARE and AGRICULTURE:

Fertilizer, 1984, 32 pp.. in **Nonpoint Source Management Handbook**, From: Long Island Regional Planning Board, Hauppauge, New York 11787. tel: 516-360-5189. Provides recommendations for administrative measures, site planning, lawn installations and maintenance, and fertilizer application.[N]

Agricultural Management Practices to Minimize Groundwater Contamination, 1987, 115 pp.. From: Environmental Resources Center, University of Wisconsin, 216 Ag. Hall, 1450 Linden Drive, Madison, WI 53706. Thorough discussion of management practices including fertilizer management, integrated pest management, and storage and handling of pesticides; lists chemical characteristics and leaching potential of pesticides.[N]

Healthy Lawns Without Chemicals, bulletin, From: Massachusetts Audubon Society, Public Information Office, Lincoln, MA 01773. tel:617-259-9500, or 1-800-541-3443 (Environmental Help Line). A public service information bulletin describing the hazards of using lawn chemicals and recommending alternatives. No charge for single copies.

National Pesticide Telecommunications Network (NPTN)-
A toll-free telephone service which operates 24 hours a day, 365 days a year and is designed to provide accurate and prompt responses to requests for information regarding pesticides. # 1-800-858-PEST.

Inventory of Pesticide Monitoring Programs, Contact: EPA Office of Pesticide Programs, tel:703-557-7499. A computerized listing of over 300 projects nationwide; includes synopsis of projects and contact people. A network for persons responsible for regulating, manufacturing and using pesticides to communicate and share information. No cost.

STORAGE OF HAZARDOUS MATERIALS:

Storing and Handling Hazardous Substances in New York State, June 1988, 100+ pp.. From: NYS-DEC, Bulk Storage Section, 50 Wolf Road, Albany, New York 12233. tel:518-457-7469. Regulatory proposals for construction, operation, and maintenance standards for facilities storing hazardous chemicals as part of NYS's Bulk Storage Act.[N]

Technology for the Storage of Hazardous Liquids-A State-of-the-Art Review, 1983, 222 pp.. From: Health Education Services, P.O. Box 7126, Albany, New York 12224. tel: 518-439-7286. Price:$15+postage. A comprehensive review of field practices and equipment for aboveground and underground storage, including data on tanks, secondary containment systems, piping, spill containment and inspection and monitoring.[E]

Siting Manual for Storing Hazardous Substances, 1984, 98 pp.. From: Health Education Services, P.O. Box 7126, Albany, New York 12224. tel: 518-439-7286. Price: $10+postage. A practical guide for local officials; discusses types of hazards, causes of leaks and spills, site evaluation procedures and practices for spill prevention and mitigation.[N][E]

High Tech and Toxics: A Guide for Local Communities, 1985, 467 pp.. From: Conference on Alternative State and Local Policies, 2000 Florida Ave., N.W. Room 408, Washington, D.C. 20009. tel:202-387-6030. Price: $25.95+10%postage payable to National Center for Policy Alternatives. Discusses the hazards and health effects associated with "high tech" industries (e.g. electronics and semiconductor manufacturing); provides technology and management practices specific to these industries; and examines strategies for control that could be implemented at the local level.[E][N]

Columbia South Shore Hazardous Materials Containment Facilities Design Handbook, 1988, 50+ pp.. From: City of Portland, Bureau of Environmental Services, 1120 SW Fifth Avenue, Room 400, Portland, Oregon 97204. tel:503-796-7740. Recommendations and requirements on hazardous materials containment systems as part of a groundwater protection scheme. Intended to assist engineers and designers.[N]

Critical Materials Handbook, 1986, 60+ pp.. From: Spokane County Engineers Office, North 811 Jefferson Street, Spokane, Washington 99260. tel:509-456-3600. Price: $3.50+postage. Describes the county's management plan concerning the use of critical materials, provides BMP's for spill prevention and control and presents specific information on structural containment design concepts;

Critical Materials Handbook, 1986, 60+ pp.. From: Spokane County Engineers Office, North 811 Jefferson Street, Spokane, Washington 99260. tel:509-456-3600. Price: $3.50+postage. Describes the county's management plan concerning the use of critical materials, provides BMP's for spill prevention and control and presents specific information on structural containment design concepts; Illustrations.[N]

RCRA/ Superfund Information Hotline-
A toll-free telephone service from EPA providing up to date information and publications concerning Federal programs on hazardous waste. 1-800-424-9436.

Printout of RCRA Permit Holders- A computer printout of license holders under the Resource Conservation and Recovery Act (generators, transporters and disposers of hazardous wastes) in each state/town is available through written request to U.S. EPA, Waste Management Division, JFK Federal Building, Boston, MA 02108, or by calling your states waste management agency/ division.

UNDERGROUND STORAGE TANKS:

Recommended Practices for Underground Storage of Petroleum, 1984, 86 pp.. From: Health Education Services, P.O. Box 7126, Albany, New York 12224. tel:518-439-7286. Price: $5+postage. Recommendations and technical guidance from the New York State Department of Environmental Conservation; covers topics on tank and piping systems design, installation, secondary containment and leak detection. Intended for engineers, inspectors, and owners who are designing or upgrading their underground facilities.[N][E]

Installation of Underground Petroleum Storage Systems, 1987,4th ed.,32 pp.. No.804-16150. From: American Petroleum Institute, Marketing Dep't.,1220 L Street N.W., Washington, D.C. 20005. tel: 202-682-8000. Technical recommendations from API concerning site analysis, materials and equipement, design, vapor recovery, etc.; Illustrations. Call API for list and status of publications because they are updated often.[N]

Underground Storage Tank Corrective Action Technologies, 1987, 150+ pp.. #EPA/625/6-87-015. From: National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. tel: 703-487-4650 for ordering. Scientific and technical guidance for leaking USTs; techniques for evaluating a leak and selecting both initial and permanent corrective actions. Emphasis on petroleum/gasoline storage; profiles on other chemical release response techniques.[N][E]

Tank Closure Without Tears: An Inspector's Safety Guide, 1988, A 30 min. videotape and 20 page companion booklet. From: New England Interstate Water Pollution Control Commission, 85 Merrimac Street, Boston, MA 02114. tel: 617-367-8522. Video/booklet may be purchased from NEIWPCC for $25. (booklet only, $5) or borrowed from NERWI, 2 Fort Road, South Portland, ME 04106, for the prepaid charge of $5.

Underground Petroleum Storage Tanks: Local Regulation of a Groundwater Hazard, 1984, 106 pp.. From: Conservation Law Foundation of New England, 3 Joy Street, Boston, MA 02108. tel: 617-742-2540. Price: $15+postage . Overview of risks related to underground storage and options for local regulatory control; model bylaw, ordinance, and permit application.[N][E]

SOURCE REDUCTION/ WASTE MINIMIZATION:

State Contacts:
Connecticut- Hazardous Waste Management Service, Suite 360, 900 Asylum Avenue, Hartford, CT 06105. tel: 203-244-2007.
Massachusetts- Office of Safe Waste Management, DEM, 100 Cambridge Street, Room 1904, Boston, MA 02202. tel: 617-727-3260 and Source Reduction Program, DEQE, 1 Winter Street, Boston, MA 02108. tel: 617-929-5982.
New York- Environmental Facilities Corporation, 50 Wolf Road, Albany, NY 12205. tel: 518-457-4139 and Division of Solid and Hazardous Waste, DEC, 50 Wolf Road, Albany, NY 12205. tel: 518-457-3273.
Rhode Island- Ocean State Cleanup and Recycling Program, DEM, 9 Hayes Street, Providence, RI 02908-5003. tel: 401-277-3434; 1-800-253-2674 (in Rhode Island).

Waste Minimization, 1987, 26 pp.. #EPA/530-SW-87-026; From: U.S. EPA, Office of Solid Waste and Emergency Response, 401 M Street, SW, Washington, D.C. 20460. Booklet; describes general waste minimization practices and lists Federal and State offices that can assist waste generators in initiating or expanding their programs.[N][E]

High Tech and Toxics: A Guide for Local Communities, 1985, 467 pp.. From: Conference on Alternative State and Local Policies, 2000 Florida Ave., N.W. Room 408, Washington, D.C. 20009. tel:202-387-6030. Price: $25.95+10%postage payable to National Center for Policy Alternatives. Discusses the hazards and health effects associated with "high tech" industries (e.g. electronics and semiconductor manufacturing); provides source reduction and resource recovery technology and management practices specific to these industries.[E][N]

Guide to Solvent Waste Reduction Alternatives, 1986, 190+pp.. From: California Department of Health Services, Alternative Technology Section, 714-744 Pete Street, Sacramento, CA. tel: 916-324-1807. Technical guidance on management practices and technologies to reduce solvent use; recycling and treatment of used solvents; and a regulatory perspective on Federal and California waste reduction programs.[N]

Alternative Technology for Recycling and Treatment of Hazardous Wastes, 1986, 186 pp.. Third Biennial Report, From: California Department of Health Services, Alternative Technology Section, 714-744 Pete Street, Sacramento, CA. tel: 916-324-1807. Informative and technical overview of many methods available to reduce, recycle and treat wastes including metals, cyanide, solvents, pcb's and dioxins. Extensive list of references.

Waste Audit Studies are available for the industries listed below from the California Department of Health Services, Alternative Technology Section, 714-744 Pete Street, Sacramento, CA. tel:916-324-1807. Each contain case studies of the industries' waste streams, recommendations to minimize wastes, and guidelines for conducting an audit. Approx. 100 pages each:

Paint Manufacturing Industry, April, 1987.
Automotive Paint Shops, January, 1987.
Automotive Repairs, May, 1987.
Pesticide Formulating Industry, November, 1987.
Printed Circuit Board Manufacturers, June, 1987.

Solid Waste Update, From: Department of Environmental Quality Engineering, Division of Solid Waste Management, 1 Winter Street, Boston, MA 02108. tel:617-292-5989. A monthly newsletter update of the activities of DEQE concerning Solid Waste Management.

Northeast Industrial Waste Exchange, 90 Presidential Plaza, Suite 122, Syracuse, NY 13202. tel:315-422-6572 or 1-800-237-2481. A waste exchange program operating in the New England/New York area to match waste generators with waste users. Services include quarterly catalog, computerized data base and recycling markets referral service.

WASTE OIL:

Used Oil in New England, 1988, 122 pp.. From: New England Waste Management Officials Association, 85 Merrimac Street, Boston, MA 02114. tel: 617-367-8558. Report explains Federal and state regulations on used oil, recommends methods to collect information on used oil generators, and discusses recycling programs in New England.[N]

Guide to Oil Waste Management Alternatives, 1988, 200+pp.. and **Oil Waste Management Alternatives Symposia: Conference Proceedings**, 1988, 200+ pp.. From: California Department of Health Services, Alternative Technology Section, 714-744 Pete Street, Sacramento, CA. tel: 916-324-1807. Detailed overview of methods and technologies available for recycling and treatment of used oil, oily wastewater, oily sludge and other wastes resulting from the use of oil products.[N]

ON-SITE DISPOSAL SYSTEMS:

Understanding Septic Systems, 1988, 25 pp.. From: Rural Community Assistance Program, 218 Central Street, Box 429, Winchendon, MA 01475. tel: 508-297-11376. Price: $2.00. Describes how septic systems work, various system designs, proper operation and maintenance, and community approaches to maintenance. Diagrams, illustrations.

Septic System Inspection and Maintenance Programs, 1982, 50+ pp.. #WM/82-05. From: Metropolitan Area Planning Council, 110 Tremont Street, Boston, MA 02108. tel: 617-451-2770. Price: $7.50+postage. Describes proper management and maintenance procedures; examples of how local officials may control on-site disposal systems.

Septic Systems and Groundwater Protection: A Program Manager's Guide and Reference Book, 1986, 70+ pp.. From: National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. tel: 703-487-4650. Order publication #PB 88112123. Price: $19.95+$3 postage. Technical assistance document for local officials from EPA Office of Groundwater. Explains hazards of septic systems and offers ideas for improving septic system management programs; model codes; references for technical assistance.

Draft Model Code for On-site Disposal of Sanitary Wastewater, 1988, From: University of Lowell, Engineering Department, Lowell, MA 01854. tel:617-452-5000. A code geared to groundwater protection, with technical annotations.[N]

National Small Flows Clearinghouse, 258 Stewart Street, P.O. Box 6064, Morgantown, WV 26506-6064. tel:1-800-624-8301. An EPA clearinghouse for information regarding on-site disposal systems; monthly newsletter with extensive publications list.

HOUSEHOLD HAZARDOUS WASTE COLLECTION:

Household Hazardous Waste: Bibliography of Useful References, 1988, 37 pp.. From: EPA RCRA/ Superfund Hotline, 1-800-424-9346. Order publication #EPA/530-SW-88-014. No charge. An up to date listing of materials, state programs, and contacts concerning household hazardous wastes and collection. [N]

Household Hazardous Waste Collection Information Kit, 20+pp.. From: League of Women Voters of Massachusetts, 8 Winter Street, Boston, MA 02108. tel: 617-357-8380. Price:$15 ($10 for non-profit groups). Information on how to set up a HHW collection day at the community level; examples of successful collection days; sample brochures and public education materials. League also provides videos and slide shows on collection programs.

Center for Environmental Management, Tufts University, Medford, MA 02155. tel:617-381-3486. Maintains a database on household hazardous waste collection programs; sponsors an annual conference, and provides general information on collection programs.

EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW (SARA TITLE III):

State Agencies responsible for Title III information:
Connecticut, DEP, Office of State Emergency Response, 203-566-4856
Maine, Emergency Management Agency, 207-289-4080
Massachusetts, DEQE, SARA Title III Office, 617-292-5810
New Hampshire, Office of Emergency Management, 603-271-2231
New York, DEC, Bureau of Spill Response and Emergency Operations, 518-457-4107
Rhode Island, DEM, Office of Air and Hazardous Materials, 401-277-2808
Vermont, Department of Health, 802-828-2886

Emergency Planning and Community Right-to-Know Information Hotline- U.S. EPA service for comprehensive and up to date explanations of Federal legislation which establishes emergency planning, methods for reporting hazardous chemical releases, and an inventory of hazardous materials storage for each State and community. Fact sheets and publications available. (Hours: 8:30 AM- 4:30 PM, Monday-Friday. This is NOT an emergency number.) 1-800-535-0202.

TRAINING AND EDUCATIONAL PROGRAMS:

Check the following organizations for training and educational programs related to hazardous materials use and/or groundwater protection:

American Ecology Services, Inc.
127 East 59th Street, New York, NY 10022. tel: 212-371-1620
Programs and conferences include groundwater issues, hazardous wastes, etc.

National Well Water Association
6375 Riverside Drive, Dublin, Ohio 43017. tel:614-761-1711
Courses, workshops and conferences on groundwater. Schedule available.

Local Groundwater Management Programs
Professional Education Department-
B12 Ives Hall, Box 700, Cornell University, Ithaca, NY 14853. tel: 607-255-7259
Occassionally offers a course in groundwater protection and management.

Environmental Hazards Management Institute
10 Newmarket Road, P.O. Box 932, Durham, NH 03824. tel:603-868-1496
Customized training programs for industry, fire departments and chemical emergency responders; training films and conferences.

Center for Environmental Management
Tufts University, Medford, MA 02115. tel:617-381-3486
Recently began a program in Hazardous Materials Management.

Resource Education Institute
P.O. Box 92, Northborough, MA 01532. tel: 617-393-8542
Workshops/ seminars on numerous topics including groundwater, pollution sources, etc.

National Fire Protection Association
Battery March Park, Quincy, MA 02269. tel: 617-770-3000
Seminars and training on fire and safety codes.

APPENDIX B

Summary of Massachusetts Drinking
Water Quality Monitoring Program

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Division of Water Supply
One Winter Street, Boston, Mass. 02108

DANIEL S. GREENBAUM
COMMISSIONER

Summary of Massachusetts Drinking Water Quality Monitoring Program

August 31, 1988

The following chart summarizes drinking water testing requirements and maximum contaminant levels (MCLs) in the State of Massachusetts. These MCLs or drinking water standards have been established by the EPA or the State of Massachusetts for the protection of the public health.

These requirements apply to all public water systems in the state. These are systems that serve drinking water to at least 25 individuals (or 15 service connections) at least 60 days of the year. There are two types of public water systems - community water systems which primarily serve year-round residents and non-community systems. Non-community systems may include restaurants, factories, schools and hospitals. Non-community systems which regularly serve 25 or more people more than 6 months of the year are called non-transient non-community water systems (NTNC) and are regulated more stringently than other non-community systems.

The MCLs listed in the attached chart apply to water which is delivered to the user's tap (as defined in 310 CMR 22.02(8)), except for volatile organic compounds and turbidity where the maximum permissible level is measured at the point of entry to the distribution system.

Determining compliance with these MCLs differs with chemical classes. The regulations must be consulted for more specific information. In specific cases, DEQE may require more frequent testing than that specified in the regulations. DEQE also utilizes health based guidance numbers for chemicals for which MCLs have not been established. A list of these is frequently updated and is available from DEQE upon request.

As a result of the Safe Drinking Water Act Amendments of 1986, the federal government will be developing a number of new testing programs over the next several years that will expand testing and set new MCLs for several organic and inorganic compounds and radionuclides and modify the requirements for coliform bacteria and lead. Massachusetts will be updating its regulations as these programs are established. Updated copies of the Massachusetts Drinking Water Regulations, 310 CMR 22.00, are available at the Statehouse Bookstore at (617)727-2834, or call DEQE Division of Water Supply for information at (617)292-5770.

MASSACHUSETTS DRINKING WATER STANDARDS AND MONITORING SCHEDULES
(310 CMR 22.00)

CHEMICAL	MCL	MONITORING FREQUENCY		
		COMMUNITY SYSTEMS		NON-COMMUNITY SYSTEMS
COLIFORM BACTERIA	1/100 ML (mean of monthly samples) 4/100 ML (mean when <20 samples/mo)	Depends on size (see Table 2 in regulations) - ranges from 1/mo for systems serving <1,000 persons to 500/mo for systems serving >4,690,000		no less than 4x/year
INORGANIC COMPOUNDS		Surface	Ground	
Arsenic	0.05 mg/L	1x/yr	1x/3ys	N/A
Barium	1.0 mg/L	1x/yr	1x/3ys	N/A
Cadmium	0.010 mg/L	1x/yr	1x/3ys	N/A
Chromium	0.05 mg/L	1x/yr	1x/3ys	N/A
Lead	0.05 mg/L	1x/yr	1x/3ys	N/A
Mercury	0.002 mg/L	1x/yr	1x/3ys	N/A
Nitrate (N)	10.00 mg/L	1x/yr	1x/3ys	same as commun.
Selenium	0.01 mg/L	1x/yr	1x/3ys	N/A
Fluoride[1]	1.4-2.4 mg/L	1x/yr	1x/3ys	N/A
Sodium[2]	20.00 mg/L	1x/yr	1x/3ys	same as commun.
ORGANIC COMPOUNDS				
Pesticides and Herbicides		Surface[3]	Ground	
Endrin	0.0003 mg/L	1x/3yrs	may be	
Lindane	0.004 mg/L	1x/3yrs	re-	May be required by
Methoxychlor	0.1 mg/L	1x/3yrs	quired	DEQE
Toxaphene	0.005 mg/L	1x/3yrs	by	
2,4-D	0.01 mg/L	1x/3yrs	DEQE	
2,4,5-TP Silvex	0.10 mg/L	1x/3yrs		
Trihalomethanes[4] (total)	0.10 mg/L	4x/system/quarter		

(cont.)

Notes

1) The MCL for fluoride is temperature dependent.

2) Water systems with > 15 mg/l sodium must monitor quarterly.

3) Surface water testing requirements are for community water systems that utilize any surface water. Systems completely relying on ground water may be required to test at DEQE's discretion.

4) Trihalomethane monitoring only applies to systems that disinfect and that serve > 10,000 persons. The monitoring frequency may be reduced in accordance with DWS policy. The trihalomethanes covered are chloroform, bromodichloromethane, dibromodichloromethane and bromoform. These are common by-products of disinfection.

MASSACHUSETTS DRINKING WATER STANDARDS AND MONITORING SCHEDULES (310 CMR 22.00) - cont'd

CHEMICAL	MCL	MONITORING FREQUENCY	
Volatile Organic Compounds (see Note 5)		Vulnerable Systems[5]	Nonvulnerable[5] (includes surface, groundwater, and non-transient, non-community systems)
Benzene	0.005 mg/L	1x/yr	1x/3yrs
Vinyl Chloride	0.002 mg/L	1x/yr	1x/3yrs
Carbon Tetrachloride	0.005 mg/L	1x/yr	1x/3yrs
1,2 Dichloroethane	0.005 mg/L	1x/yr	1x/3yrs
Trichloroethylene	0.005 mg/L	1x/yr	1x/3yrs
1,1 Dichloroethylene	0.007 mg/L	1x/yr	1x/3yrs
1,1,1 Trichloroethane	0.20 mg/L	1x/yr	1x/3yrs
para-Dichlorobenzene	0.075 mg/L	1x/yr	1x/3yrs
		COMMUNITY SYSTEMS: Surface / Ground	NON-COMMUNITY SYSTEMS
TURBIDITY	1 TU	1x/day / N/A	1x/day for surface waters (may be reduced)
RADIONUCLIDES		COMMUNITY SYSTEMS	NON-COMMUNITY SYSTEMS
Gross Alpha Activity[6]	15 pCi/L	4 per year every 4 years for ground and surface waters. If levels < ½ MCL, may test 1x/4 yrs	N/A
Radium-226 & 228	5 pCi/L		
Beta Particle Activity[7]	4 Millirem/y	1x/4yrs for surface water systems serving > 100,000 persons	N/A
Photon Activity[7]	4 Millirem/y		
Tritium	20,000pCi/L		
Strontium-90	8 pCi/L		

Notes

5) The MCLs for the volatile organic compounds (VOCs) listed will go into effect on January 9, 1989. Testing for this new program is phased in with systems serving > 10,000 beginning testing in 1988, < 10,000 > 3,300 testing in 1989 and < 3,300 testing in 1991. For the initial year of testing, surface water supplies must be tested once per quarter and groundwater supplies must be tested in the first and third quarters. Monitoring for 51 unregulated volatile organic compounds is also required. Subsequent monitoring frequency will be based on system vulnerability to VOC contamination, as determined by DEQE.

6) Gross alpha particle activity includes radium-226 but excludes radon and uranium.

7) For total beta particle and photon radioactivity, MCLs are set at the average annual concentration which produces an annual dose equivalent to the total body or any internal organ greater than 4 millirem per year.

APPENDIX C

Emergency Regulations - Site Assignment for
Solid Waste Facilities
Department of Environmental Quality Engineering
310 CMR 16.00

SECRETARY OF STATE
RULES AND REGULATIONS
DIVISION

MAY 27 3 22 PM '88

#152

The Commonwealth of Massachusetts

Office of the Secretary of State

Regulation Filing *To be completed by filing agency*

CHAPTER NUMBER: 310 CMR 16.00

CHAPTER TITLE: Site Assignment for Solid Waste Facilities

AGENCY: Department of Environmental Quality Engineering

SUMMARY OF REGULATION

State the general requirements and purposes of this regulation:

These regulations address four aspects of site assignment for solid waste facilities

1. Process for submittal of Site Assignment Applications to boards of health.
2. Procedures for DEQE evaluation of the site suitability and for Department of Public Health to comment on sites.
3. Criteria for DEQE and boards of health to use to determine if a site constitutes a danger to public health, safety, or the environment.
4. Guidance to boards of health on application fees to be paid by applicant to cover costs of technical review, technical assistance and public hearings.

REGULATORY AUTHORITY: C. 584 of the Acts of 1987

AGENCY CONTACT: Beatrice Nessen PHONE: (617) 292-5590

ADDRESS: DEQE/Division of Solid Waste Management, One Winter St., Boston, MA 02108

Compliance with M.G.L. C.30A, and Promulgation and Attestation

EMERGENCY ADOPTION

If this regulation is adopted as an emergency regulation, state the nature of the emergency:

See Attachment A

PRIOR NOTIFICATION AND/OR APPROVAL

If prior notification to and/or approval of the Governor, legislature or others was required, list each notification, approval and date, including notice to the local Government Advisory Commission.

Not applicable to Emergency Regulations

PUBLIC REVIEW

Was notice of the hearing or comment period filed with the Secretary of State, published in appropriate newspapers and sent to persons to whom specific notice must be given at least 21 days prior to such hearing or comment period?

Yes ☐ Date of public hearing or comment period: N/A

FISCAL EFFECT

Estimate the fiscal effect on the public and private sectors: See Attachment B

For the first and second years: _____

For the first five years: _____

No fiscal effect: ☐

CODE OF MASSACHUSETTS REGULATIONS INDEX

List key subject entries that are relevant to this regulation:

Solid Waste Facilities, Site Assignment, DEQE, DPH

PROMULGATION

State the action taken by this regulation and its effect on existing provisions of the Code of Massachusetts Regulations (CMR) to repeal, replace or amend. List by CMR number:

N/A

ATTESTATION

The regulation described herein and attached hereto is a true copy of the regulation adopted by this agency.

ATTEST: _____ Date: 5/27/88

Signature

Publication

To be completed by the Regulations Division

MASSACHUSETTS REGISTER NUMBER: 584

DATE: 6/10/88

EFFECTIVE DATE: 6/10/88

CODE OF MASSACHUSETTS REGULATIONS

Remove these pages:	*Insert these pages:*
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Michael Joseph Connolly

MICHAEL JOSEPH CONNOLLY
SECRETARY OF STATE

DATE 5/27/88 CLERK

Attachment A

EMERGENCY FINDING
for Regulations for Site Assignment of Solid Waste Facilities
310 CMR 16.00

The process and considerations by which towns and municipalities assign places as sites for solid waste facilities, as set forth in G.L.c.111,s.. 150A, have been substantially altered by amendment to s. 150A, and by the insertion of s. 150A 1/2, which sets forth sixteen "considerations", which are to govern the development of site suitability criteria by the Department of Environmental Quality Engineering (Sections 16 and 17, respectively, of c. 584, St. 1987, effective December 17, 1987)

The Department of Environmental Quality Engineering, working with an advisory committee, is directed to promulgate rules and regulations "to establish siting criteria and procedures to be utilized by local boards of health in any decision to assign or refuse to assign a facility pursuant to the provisions of section one hundred and fifty A of chapter one hundred and eleven of the General Laws..." by April 15, 1988 ("[W]ithin one hundred and twenty days of the effective date of the act") s. 33, c.584, St. 1987..

The legislature has determined, as set forth in G.L.c. 21 H. ss (a) (2) and (3) (inserted by section n 3 of c. 584, St. 1987) that:

(2) There is pending throughout the commonwealth a severe shortage in environmentally safe and financially sound capacity for the shortage, disposal and processing of solid waste.

(3) The provision of such capacity is an essential public purpose, will constitute the performance of an essential public function and is necessary to the preservation and improvement of the health, welfare and living conditions of the people of the Commonwealth, the promotion of industry and employment and all aspects of commerce, the maintenance, protection conservation and development of safe water supplies, and the protection of the environment overall.

The Department finds that the absence of rules and regulations governing the site assignment process set forth in G.L. c. 111. s.150A, as amended, and setting forth siting criteria in accordance with the siting considerations set forth in G.L. c. 111, s.150A/2 has created and will continue to create confusion by all participants in the siting process as to the boards' ultimate authority in making siting determinations in the absence of rules and regulations. This has the effect of staying the assignment of proposed sites which will exacerbate the pending shortage of environmentally sound disposal capacity and processing facilities. The Department is not able to promulgate such regulations by or about April 15, 1988 without resort to the emergency regulationn provisions of G.L. c. 30 A, s. 2. The

immediate adoption of this emergency regulation pending the notice and public hearing reguirements generally required under the first four paragraph of G.L. c. 30A, s. 2 is therefore necessary for the preservation of the general welfare. Failure to promulgate these regulations as emergency regulations would be contrary to the public interest. These emergency regulations shall be in effect for three months.

Attachment B

Fiscal Impact Statement for Regulations for Site Assignment of Solid Waste Facilities 310 CMR 16.00

These regulations, 310 CMR 16.00, were mandated by the Chapter 584 of the Acts of 1987 and pertain to site assignment of solid waste facilities. They regulate the procedure by which applications for site assignment applications are submitted to the board of health and by which DEQE and the Department of Public Health review the suitability of the site; the public hearing held by the board of health; and the fees which boards of health may charge applicants. The regulations also set the standards and criteria for evaluating the suitability of a site.

While the new procedural requirements will increase the cost of the site assignment process to both the public and private sectors, the fiscal effect is difficult to estimate since it will depend upon the number, type, and size of the facilities proposed and the actual costs of technical review and assistance.

a. Private Sector Impacts

1. Preparation of the Site Assignment Applications - Costs will include those associated with the retaining of a professional engineer and other professionals to prepare application, including performance of environmental analysis and compiling of data. They may range from $10,000 to $300,000 depending upon size and facility type. Some of this work is applicable to the MEPA submittal, both for the site assignment application and the facility permit.

2. Application Fee - C 584 authorizes the board of health to charge a fee to cover the costs of application review and public hearing. The fees set in the regulations may range from $3,000 to $35,000 depending upon type and size of the facility. The regulations set maximum fees with a refund to the applicant of any amount in excess of the expenses incurred by the board of health.

b. Public Sector Impacts

1. Board of Health - Major costs will be for the review of the application and the public hearing. Application fees paid to the board of health cover technical review and public hearing costs. The fee for technical review provides for 100% reimbursement for technical review costs and 50% for technical assistance costs. The public hearing fee will cover 100% of all eligible costs (those which are beyond normal municipal expenses incurred in conducting public hearings). Costs incurred by the municipality in excess of fee ceilings allowed by the fee regulations are borne by the municipality. It is difficult to estimate such excess costs, but they should not be normal occurences since fees are based on size.

2. DEQE - Additional staffing costs will be incurred by the Department in order to conduct review of Site Assignment Applications and evaluate the suitability of sites. There is also potential of additional costs associated with appeals of DEQE decisions. It is difficult to estimate exact staff requirements since the projected number of applications which will be submitted is unknown.

3. Department of Public Health - Additional staffing costs will be entailed by DPH which is required to comment on applications and may submit reports to boards of health on public health aspects of the site assignment applications. The cost can not be estimated since it will vary by size and type and the number of requisites for reports.

310 CMR 16.00: SITE ASSIGNMENT REGULATIONS FOR SOLID WASTE FACILITIES

Section

PART I: PROCEDURES FOR SUBMISSION AND REVIEW OF SITE ASSIGNMENT APPLICATIONS

16.01: Purpose and Authority
16.02: Definitions
16.03: Time
16.04: Severability
16.05: Applicability
16.06: Prohibitions
16.07: Certification
16.08: Submission Requirements
16.09: Public Access to Application
16.10: Review of Application for Completeness
16.11: Review Period
(16.12: Reserved)
16.13: Department Report On Suitability (Report)
16.14: Reconsideration of Findings
16.15: Further Action on Application
16.16: Requests for Technical Assistance from the Department
16.17: Application Review by the Department of Public Health
16.18: Waiver
(16.19: Reserved)

PART II: BOARD OF HEALTH PUBLIC HEARINGS

16.20: Public Hearing Rules
(16.21-16.29: Reserved)

PART III: APPLICATION FEE

16.30: Fees
(16.31-16.39: Reserved)

PART IV: SITE SUITABILITY CRITERIA

16.40: Site Suitability Criteria
(16.41-16.98: Reserved)
16.99: APPENDIX A

PART I: PROCEDURES FOR SUBMISSION AND REVIEW OF SITE ASSIGNMENT APPLICATIONS

16.01: Purpose and Authority

(1) Purpose. These regulations are composed of four Parts pertaining to the process for deciding whether a parcel of land is suitable to serve as the site for a solid waste management facility. The first Part describes the procedures for submitting an application to the Department and the board of health for site assignment and sets forth the review process used by the Department in determining whether a site is suitable. Part I is intended to provide for the complete submission of information necessary for determining site suitability and for extensive opportunity for public comment within a relatively short review period. The second Part sets forth rules governing the Public Hearings to be held by the board of health for the purpose of assigning a site. The third Part sets forth the process by which the board of health assesses the Application Fee and the allowed expenditures of those funds for reviewing the application and conducting the public hearings. The final Part establishes the site suitability criteria that are to be applied by the Department and the board of health in determining whether a site is suitable. Part IV is intended to make the siting of facilities subject to consistent standards and provide for the protection of public health and safety and the environment.

16.01: continued

(2) Authority. These regulations are promulgated by the Department of Environmental Quality Engineering pursuant to M.G.L. c. 21A, ss. 2 & 8, c. 21, s. 27 and c. 111, ss. 150A and 150A1/2.

16.02: Definitions

The following words when used herein, except as otherwise required by the context, shall have the following meaning:

Adjacent Area means a parcel of land contiguous to a site or in close enough proximity to be directly impacted by water, air or soil borne pollutants, not exceeding a one half-mile radius from the site.

Adverse Impact means an injurious impact which is not de minimus in relation to the public health, safety, or environmental interest being protected.

Applicant means the person named in the application as the owner of a property interest in the site and the operator of the proposed facility where the owner has entered into an agreement with an operator at the time the application is filed.

Area of Critical Environmental Concern (ACEC) means an area designated by the Secretary of the Executive Office of Environmental Affairs pursuant to 301 CMR 12.00, Areas of Critical Environmental Concern.

Commissioner means the Commissioner of the Department of Environmental Quality Engineering.

Compostable Material means an organic material, excluding wastewater treatment sludge, which:

(a) is not co-mingled or contaminated with significant amounts of solid waste or toxic constituents; and

(b) shall be utilized as an ingredient or a feedstock in a composting process.

Composting means a process of accelerated biodegradation and stabilization of organic material under controlled conditions yielding a product which can safely be used for agricultural and horticultural purposes.

Department means the Department of Environmental Quality Engineering.

Department Report on Suitability means the report issued by the Department pursuant to M.G.L. c. 111, s. 150A1/2, stating whether a site proposed for a solid waste management facility in an application for a site assignment is suitable.

Disposal Facility means any sanitary landfill or solid waste combusion facility rated by the Department at more than one ton per hour.

Downgradient means:

(a) in reference to surface water, the direction perpendicular to lines of equal elevation over a distance in which elevation continuously decreases, measured from the point or area in question; or

(b) in reference to ground water, the direction perpendicular to lines of equipotential over a distance in which total head continuously decreases, measured from the point or area in question.

Existing Public Water Supply see Public Water Supply.

Expand a Site means to move a solid waste facility's operation to a previously unassigned site that is contiguous to the original site or to modify a solid waste facility's operations causing it to exceed any capacity or total volume limit stated in its current site assignment.

Interim Wellhead Protection Area (IWPA) means an area extending to a one-half mile radius from a public water supply wellhead which is intended to protect the wellhead pending the delineation of its Zone II.

16.02: continued

Perennial Water Course means a stream or river that flows year round.

Operator means any person who has care, charge or control of a facility subject to these regulations, including without limitation, an agent, lessee of the owner or an independent contractor.

Person(s) means a private person, firm, or corporation, or any federal, state, or local governmental or other entity which is not an agency.

Potential Private Water Supply means an uncontaminated aquifer capable of yielding water of sufficient quality and quantity which is located under a parcel of land that at the time of the earlier of the following two filings, the Site Assignment Application or where applicable, the MEPA Environmental Notification Form, is:

(a) zoned residential or commercial;
(b) not served by a public water supply; and
(c) subject to a subdivision plan or a building permit application approved by the appropriate municipal authority.

Potential Public Water Supply means a drinking water source which at the time of the earlier of the following two filings, the Site Assignment Application or where applicable, the MEPA Environmental Notification Form:

(a) has been zoned as an aquifer protection area or district and has been determined to be capable of yielding water of sufficient quality and quantity for future development as a public water supply; or
(b) has been designated and received Departmental approval under the "New Groundwater Source Approval Guideline", 1984, as amended; or
(c) for which the Department has received the necessary submissions for determination as a Potential Public Water Supply as defined by the Department's Division of Water Supply.

Public Water Supply means a source of drinking water supplying a public water system as defined in 310 CMR 22.00, as may be amended.

Recyclable Material means a discarded material which:

(a) is not co-mingled or contaminated with significant amounts of solid waste or toxic constituents; and
(b) shall be utilized as an ingredient or a feedstock in a recycling process which will result in a beneficial use as a raw material or a finished product.

Recycling means any method, technique, or system utilized to process or treat discarded materials to yield products which may be beneficially used or reused. Recycling does not include the recovery of energy from combustion of a material.

Regional Disposal Facility means a solid waste facility that is a member of a regional disposal district established in accordance with M.G.L. c. 40, s. 44K, or a solid waste facility that receives substantial quantities of solid waste on a regular basis from 2 or more municipalities.

Restricted Area means an area specified in 310 CMR 16.40(3) and (4) from which a solid waste management facility is excluded.

Review Period means the sixty (60) day period during which the Department shall review the Site Assignment Application and issue the Department report.

Site Assignment means a determination by a board of health or by the Department, where appropriate, as specified in M.G.L. c. 111, s. 150A that:

(a) designates an area of land for a specific solid waste use subject to conditions with respect to the extent, character and nature of the facility that may be imposed by the assigning agency after a public hearing; or
(b) establishes that an area of land was utilized as a site for the disposal of solid waste prior to July 25, 1955 as provided in St. 1955, c. 310, s. 2.

16.02: continued

Sole Source Aquifer means an aquifer so designated by the U.S. Environmental Protection Agency, or by the Department under the authority of a state program as may be established.that supplies fifty (50) percent or more of the drinking water for the aquifer service area, and the volume of water which could be supplied by alternative sources is insufficient to replace the petitioned aquifer should it become contaminated.

Solid Waste or Waste means useless, unwanted or discarded solid, liquid or contained gaseous material resulting from industrial, commercial, mining, agricultural, municipal or household activities that is abandoned by being disposed or incinerated or is stored, treated or transferred pending such disposal, incineration or other treatment, but does not include:

(a) hazardous wastes or regulated recyclable materials as defined and regulated pursuant to 310 CMR 30.000;

(b) sludge or septage which is land applied in compliance with 310 CMR 32.00;

(c) sludge or sludge ash from publicly or privately owned wastewater treatment plants which is treated and disposed at a site regulated pursuant to 314 CMR 12.00;

(d) septage, as defined and regulated pursuant to M.G.L. c. 111, s. 31D;

(e) sewage;

(f) ash produced from the combustion of coal when reused as prescribed pursuant to M.G.L. c. 111, s. 150A;

(g) solid or dissolved materials in irrigation return flows;

(h) solid or dissolved materials in domestic sewage;

(i) source, special nuclear or by-product material as defined by the Atomic Energy Act of 1954, as amended;

(j) those materials and by-products generated from and commonly reused within an original manufacturing process; and

(k) compostable or recyclable materials when utilized in a facility exempted pursuant to 310 CMR 16.05(2)(f), (g) and (i).

Solid Waste Management Facility (Facility) means an established site or works, and other appurtenance thereto, which has been or will be used for the storage, transfer, processing, treatment or disposal of solid waste including all land, structures, and improvements which are directly related to solid waste management activities.

Source Separated means dividing or maintaining compostable or recyclable material distinct from solid waste at a site different than the side of recycling or composting operation.

Suitable means a determination by the Department that a proposed site meets the Site Suitability Criteria as set forth in these regulations 310 CMR 16.00.

Upgradient means:

(a) in reference to surface water, the direction perpendicular to lines of equal elevation over a distance in which elevation continuously increases, measured from the point or area in question; or

(b) in reference to groundwater, the direction perpendicular to lines of equipotential over a distance in which total head continuously increases, measured from the point or area in question.

Waste Handling or Processing Area means an area where waste is stored, processed or otherwise handled, excluding weigh stations or access roads.

Waste Handling or Processing Facility means a non-disposal solid waste facility used primarily for the storage, transferring, treating, compacting or processing of solid waste.

Zone II means that area of an aquifer which contributes water to a well under the most severe recharge and pumping conditions that can be realistically anticipated (i.e., pumping at the safe yield of the well for 180 days without any natural recharge occurring); it is bounded by the groundwater divides which

16.02: continued

result from pumping the well and by contact of the edge of the aquifer with less permeable materials such as till and bedrock. At some locations, streams and lakes may form recharge boundaries. For the purposes of these regulations, a Zone II area is one which has been defined and delineated in accordance with the Department's Division of Water Supply "Guidelines for Public Water Systems", September, 1984 Supplement to the 1979 edition or the most recent version thereof.

16.03: Time

(1) Computation of Time. Unless otherwise specifically provided by law, 310 CMR 16.00, and any determination issued pursuant to 310 CMR 16.00, any time period prescribed or referred to in 310 CMR 16.00 shall begin with the first day following the act which initiates the running of the time period, and shall include every calendar day, including the last day of the time period so computed. If the last day is a Saturday, Sunday, legal holiday, or any other day in which the Department's offices are closed, the time period shall run until the end of the next business day. If the time period prescribed or referred to is six (6) days or less, only days when the offices of the Department are open shall be included in the computation.

(2) Timely Filing. Papers required or permitted to be filed under these regulations, or any provision of the applicable law must be filed at the board of health office or such other place as the board of health, Department or these regulations shall designate within the time limits for such filings as set by these regulations. Papers filed in the following manner shall be deemed to be filed as set forth herein:

(a) hand-delivery during business hours shall be deemed filed on the day delivered;

(b) hand-delivered during non-business hours shall be deemed filed on the next regular business day; and

(c) mailing by placing in U.S. mail shall be deemed filed on the date so postmarked.

(2) All papers shall show the date received by the board of health and the Department, and the board of health and the Department shall cooperate in giving date receipts to Persons filing papers by hand-delivery.

16.04: Severability

It is hereby declared the provisions of 310 CMR 16.00 are severable, and if any provision hereof or the application thereof to any person or circumstance is held invalid, such invalidity shall not affect other provisions of these regulations, and the application thereof to persons or circumstances which can be given effect without the invalid provision or application.

16.05: Applicability

(1) General. These regulations shall govern the process of application, review, public hearing and decision for a site assignment to Expand a Site or establish a new facility at an unassigned site, except for those facilities exempted in 310 CMR 16.05(2).

(2) Exemptions. The following facilities, containers, and operations are exempt from these regulations:

(a) facilities that manage hazardous wastes which are regulated pursuant to 310 CMR 30.000;

(b) disposal areas for agricultural wastes generated by a single family residence or a small scale farming operation when such wastes are generated and disposed of within the boundaries of such residence or farm;

(c) transfer or storage containers located at, and used exclusively for the solid waste generated by an apartment house or complex, school, park, industrial or commercial establishment, individual residence or farm;

(d) refuse incinerators that are rated by the Department at less than one (1) ton per hour;

16.05: continued

(e) the use or application of agricultural waste or manures in normal farming operations, if the proposed use or application of the waste or manures incorporates good management practice and is done in a manner to minimize pollution to air, water, or other natural resources of the Commonwealth;
(f) a works located at an agricultural unit, as defined in M.G.L. c. 128, s. 1A, used to compost only the following source separated materials:
1. discarded materials resulting from the normal cutting of crops or the maintenance of plant growing facilities;
2. discarded by-products from the processing of fruit and vegetables;
3. animal manures, including bedding;
4. deciduous and coniferous seasonal deposition (eg. leaves), grass clippings, weeds, hedge clippings and garden materials; or
5. discarded materials consisting of trees, stumps and brush, including sawdust, chips, shavings and bark, but not including wood pieces or particles containing chemical preservatives such as creosote, pentachlorophenol, paints, stains other coatings;
6. clean newspaper or cardboard where used as a bulking agent;
(g) operations or works which compost source separated leaf and yard materials, including only deciduous and coniferous seasonal deposition, grass clippings, weeds, hedge clippings and garden materials;
(h) operations which collect, store, and process only beverage containers subject to the provisions of M.G.L. c. 94, ss. 321 - 326; and
(i) industrial and manufacturing operations, or works, or classes thereof, processing or storing only recyclable or compostable materials subject to a prior written Department determination of beneficial use.

16.06: Prohibitions

No place in any city or town shall be maintained or operated as a site for a facility unless such place has been assigned by the board of health or the Department, whichever is applicable, pursuant to M.G.L. c. 111, s. 150A. Any disposal of solid waste at any location not so assigned shall constitute a violation of said statute and of these regulations, 310 CMR 16.00.

16.07: Certification

Any person, required by these regulations or any order issued by the Department, to submit papers shall identify themselves by name, profession, and relationship to the applicant and legal interest in the proposed site, and make the following certification: "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties both civil and criminal for submitting false information including possible fines and imprisonment."

16.08: Submission Requirements

(1) General. Any person wishing to establish a new facility on a site that has not previously been assigned or to Expand a Site must file a Site Assignment Application (application) with the board of health and provide copies to the Department and the Department of Public Health.

(2) Copies. The applicant shall file:
(a) two (2) copies of the application with the local board of health;
(b) three (3) copies of the application with the Department, two (2) of which to the Division of Solid Waste Management, Boston, and one (1) to the regional office in which the proposed site is located.
(c) one (1) copy of the application with the Department of Public Health, Bureau of Environmental Health Services, Boston.

(3) Service of Copies. Simultaneous with the filing of any and all papers with

16.08: continued

the board of health, the applicant filing such papers shall send a copy(ies) to the Department and the Department of Public Health, as prescribed in 310 CMR 16.08(2). All papers filed with the board of health shall be accompanied by a certificate signed under the pains and penalty of perjury that copies have been sent, specifying the mode of service, date mailed or delivered, the address, and address of service. Failure to comply with these requirements shall be grounds for refusal by the board of health or the Department to accept papers for filing.

(4) Fees. The applicant shall tender payment of the Technical Fee in a manner prescribed by the board of health or enter into alternative fee payment arrangements to the satisfaction of the board of health.

(5) Site Assignment Application.

(a) General. The application shall be completed using forms supplied by the Department and shall contain sufficient data and other relevant information to allow the Department and the board of health to determine, independent of additional information, whether the site is suitable.

(b) Preparation of Papers. All papers pertaining to design, operation, maintenance, or engineering of a site or a facility shall be prepared under the supervision of a registered professional engineer knowledgeable in solid waste facility design, construction and operation and shall bear the seal, signature and discipline of said engineer. The soils, geology and groundwater sections of an application, if applicable, shall be completed by professionals experienced in those fields under the supervision of a registered professional engineer. All mapping and surveying shall be completed by a registered surveyor.

(c) Waiver. The application shall clearly state whether a waiver, as provided in 310 CMR 16.18 or 310 CMR 16.40(6), is requested. Applications for waivers shall be independent of the main body of the Site Assignment Application and shall include:

1. reference to the specific criteria or provision for which the waiver is requested;
2. all documentation that the applicant wants to present in support of the waiver including detailed facility design plans where appropriate.

(d) Massachusetts Environmental Policy Act (MEPA). The application shall include certification that the applicant has complied with the MEPA process for the determination of the site's suitability, if applicable.

(e) Signatures. Applications shall be signed and sworn to by the applicant(s) and his/her agent, if different, as to all statements of fact therein, as set forth in 310 CMR 16.07.

16.09: Public Access to Application

The board of health shall ensure that a copy of the application and all subsequent filings are available for reasonable public inspection and copying. The board of health may charge reasonable fees for such copying.

16.10: Review of Application for Completeness

(1) Report Number. The Department shall assign a Report Number to each application when the application is filed with the Department and notify the applicant, the board of health, and the Department of Public Health. The Report Number shall be used in all subsequent correspondence with the board of health, the Department, the applicant and the Department of Public Health and shall appear on any subsequent filings by the applicant.

(2) Public Comments. During the Determination Period, as defined in 310 CMR 16.10(3) the Department shall accept written comments from the board of health or interested persons regarding the completeness of the application.

(3) Determinations. The Department shall issue a written determination to the applicant as to the completeness of the application on or before twenty-one (21) days after the filing of said application, the Determination Period. An application shall not be considered complete unless the Technical Fee, if any,

16.10: continued

has been paid and the application forms are complete and accompanied by the appropriate supporting documentation. If the Department determines that the application is incomplete, deficiencies shall be stated. The Department shall send a copy of such determination to the board of health and the Department of Public Health.

(4) Public Notice of Application. The applicant, after receipt of notice of completeness from the Department, shall notify abutters to the site and provide public notice that an application has been filed with the local board of health. The notice shall:

(a) appear in at least one (1) newspaper that has general circulation within the municipality; and

(b) include the location of the site; the size of the site: the type of facility; the type of waste or material to be handled at the facility; daily tonnage or throughput; the names, and addresses of the proponents; the public location within the community and hours where the application may be inspected; the time period for comment to be received by the Department and the address to which the comments should be mailed.

(5) Commencement of Review Period. The Department Review Period shall commence when the applicant has provided proof to the Department that the public notice requirement as set forth in 310 CMR 16.10(4) above has been satisified. Proof may be in the form of a copy of the public notice in the publication.

16.11: Review Period

(1) General. Upon commencement of the Review Period, the Department shall review the application to determine if the site is suitable.

(2) Public Comments. During the initial twenty-one (21) days of the Review Period the Department shall accept written comments from the board of health or other interested persons regarding the suitability of the site. All comments shall be filed with the Department's Regional Office in which the proposed site is located. The Department shall make available all comments received regarding the application to the applicant and the board of health at their request.

(3) Applicant Response and Modification.

(a) Response to Comments. The applicant may respond in writing and/or the Department may require the applicant to respond to comments during the initial forty (40) days of the Review Period.

(b) Modification of Application. During the initial forty (40) days of the Review Period the applicant may modify an application provided that said modifications, when taken in their totality, do not constitute a major modification. The Department shall determine if modifications are major and issue written notice of such determinations to the applicant.

(c) Major Modifications. The applicant must notify the Department and the board of health within five (5) days of receipt of a notice from the Department that a single modification or a series of modifications constitute a major modification, whether it intends to:

1. withdraw the application; or
2. withdraw the modifications and let the Department review of the application continue on the unmodified application.

(3) Failure of the applicant to file a notification within the appropriate time will constitute a withdrawal pursuant to 310 CMR 16.11(3)(c)2.

(4) Additional Information. The Department may require the applicant to provide additional information as the Department deems necessary to fully evaluate if the site is suitable.

(5) Restricting of Comments or Response. After forty (40) days the Department may restrict further comments or responses to allow the completion of the Department review of the site.

16.11: continued

(6) Issuance of Report. The Department shall issue the Report on Suitability (Report) within sixty (60) days of the receipt of proof that the public notice requirement set forth in 310 CMR 16.10(4) has been satisfied.

(16.12: Reserved)

16.13: Department Report On Suitability (Report)

(1) General. The Department shall forward the Report and the accompanying record to the board of health and shall provide a copy of the Report to the applicant.

(2) Content. The Report shall include:
(a) the Report Number;
(b) a statement indicating that the application does or does not contain sufficient data to allow the Department to determine if the site meets the criteria. A determination that an application did not contain sufficient information to allow a determination on each criteria shall be sufficient grounds for a negative determination of suitability;
(c) a statement that the site meets or fails to meet each the site suitability criteria set forth in 310 CMR 16.40, including any conditions; and
(d) findings of fact pertaining to the application, any waiver that was requested, and the suitability of the site.

(3) Basis for Report. The Report shall be based upon:
(a) the record;
(b) the facts and information otherwise available to the Department;
(c) expertise of the Department;
(d) expertise of other local state or federal agencies consulted by the Department.

(4) Record. The record shall consist of the application, including any waivers requested or any modifications submitted; any report or records the Department has used in making its determination; and any and all correspondence, notices, and written comments by the Department, boards of health, applicant or the public which have been submitted in accordance with 310 CMR 16.00.

(5) Public Access. The board of health shall ensure that the the Department's Report on Suitability and the Department Record are made available for copying and reasonable inspection.

16.14: Reconsideration of Findings

(1) Motions for Reconsideration. When the Department's Report contains a finding that the site fails to meet the site suitability criteria, the Department may entertain written motions for reconsideration from the applicant stating the basis on which the reconsideration is requested, if filed within fourteen (14) days of issuance of the Report. The motion for reconsideration shall state the fact(s) which it is contended the Department has overlooked or misapprehended and shall contain such argument in support of the motion as the applicant desires to present. Action on any motion for reconsideration is at the discretion of the Department.

(2) Comments. The Department may allow comments from the board of health, the Department of Public Health and the general public for a specified time period if it decides to reconsider the findings.

(3) Reissuance of Report. In the event the Department reconsiders and changes its determination, it shall amend the Report accordingly and reissue the Report.

16.15: Further Action on Application

(1) Negative Determinations of Suitability. When the Department issues a Report with a finding that a site fails to meet the site suitability criteria or that an application does not contain sufficient data to allow a determination on the criteria, the site assignment process is complete and the board of health shall not hold a public hearing as prescribed in 310 CMR 16.20, provided that an applicant may request the Department to reconsider the findings in the Report and the Report may be reissued.

(2) Positive Determinations of Suitability. When the Department issues a Report with a finding that the site does meet the site suitability criteria, the board of health shall proceed to hold a public hearing pursuant to 310 CMR 16.20 for the purpose of deciding whether to grant or refuse to grant a site assignment for the parcel of property which is the subject of the Department Report.

16.16: Requests for Technical Assistance from the Department

(1) Technical Assistance. The board of health may request advice, guidance, or technical assistance from the Department to assist in the review of the information contained within the application or the Report. Any request for technical assistance shall be in writing. The technical assistance from the Department shall stop on the date of the first scheduled public hearing, except where it will serve to clarify information contained within the Department Report.

(2) Informal Arrangements. After a request for technical assistance, the Department and the board of health may enter into informal arrangements to facilitate the review of the application, provided that the applicant is informed of any such arrangement.

16.17: Application Review by the Department of Public Health

(1) Review and Comments. The Department of Public Health (DPH) shall review the application and comment as to any potential adverse impacts the site may have on public health and safety. Such review and comment shall be made no later than sixty (60) days after the start of the Review Period. The Department of Public Health may submit or discuss its comments with the Department during the Review Period.

(2) Department of Public Health Report. The Department of Public Health at the written request of the board of health shall make or have made a written report containing its comments on the potential adverse impacts of the site on public health and safety and may submit said report no later than sixty days after the start of the Review Period. The DPH may submit such report to the board of health.

(3) Coordination with Board of Health. The DPH shall coordinate and cooperate with the board of health on any matter relating to the report upon written request by the board of health to DPH.

16.18: Waiver

(1) General. The Commissioner may waive any provision or requirement contained in Part I of 310 CMR 16.00 not specifically required by law where the Commissioner finds:

(a) that the waiver is necessary to accommodate an overriding community, regional or state public interest; and

(b) the granting of the waiver would not interfere with the ability of the board of health to fullfill its duties; and

(c) the granting of the waiver would not diminish the ability of the general public to review and comment on the proposed project.

(2) Filings. All requests for waivers shall be filed and documented in accordance with section 310 CMR 16.05(5)(c).

(16.19: Reserved)

PART II: BOARD OF HEALTH PUBLIC HEARINGS

16.20: Public Hearing Rules

(1) Preamble. "Public Hearings" pursuant to M.G.L. c. 30A are not "Adjudicatory Proceedings" within the meaning of M.G.L. c. 30A, s. 1. See M.G.L. c. 30A, s. 2. Pursuant to M.G.L. c. 111, s. 150A, however, "for the limited purpose of appeal from such public hearings, a local board of health shall be deemed to be a state agency under the provisions of said chapter thirty A and its proceedings and decision shall be deemed to be a final decision in an adjudicatory proceeding". The public hearing process is designed to permit the flexibility and informality appropriate to the board of health proceeding, while providing the board of health with procedural direction and the authority to create a record and render a decision within a limited time period which is amenable to the procedures and the standards of judicial review applicable under M.G.L. c. 30A, s. 14.

(2) Applicability. This Section, 310 CMR 16.20, governs the conduct of public hearings by a board of health on a Site Assignment Application following the issuance of a Report by the Department finding that a proposed site is a suitable for a specified type(s) of solid waste facility(ies), as required by M.G.L. c. 111, s. 150A.

(3) Public Hearing Definitions. The following words when used in this section, 310 CMR 16.20, shall, except as otherwise required by context, have the following meaning:

Applicant means person named in the application as the owner of a property interest in the site and the operator of the proposed facility where the owner has entered into an agreement with an operator at the time the application is filed.

Authorized Representative means individual authorized by a party to represent him in these matters.

Board of Health or (Board) means legally designated health authority of the city, town or other legally constituted governmental unit within the Commonwealth having the usual powers and duties of the board of health of a city or town, or its authorized agent or representative; provided that in any case in which a solid waste management facility extends into the geographic areas of two or more boards of health, said boards may coordinate activities in effecting compliance with these regulations for the management of solid waste.

Decision means final decision rendered by the board of health.

Department means Department of Environmental Quality Engineering.

Department Report On Suitability means a written report issued by the Department stating whether the proposed site meets the criteria established under M.G.L. c. 111, s. 150A 1/2 and 310 CMR 16.00.

Hearing Officer means an individual(s) duly designated by the board of health to conduct the public hearing.

Papers means all written communications filed in the public hearing, including motions and other documents.

Party means applicant and any abutter(s), group of ten citizens or other intevenor duly registered pursuant to 310 CMR 16.20(9)(b).

Person(s) means a private person, firm, or corporation, or any federal, state, or local governmental or other entity which is not an agency.

Subpoena means a document which commands a witness to appear at a given time and give testimony before a court or an administrative proceeding such as a hearing; and may require the witness to produce before the hearing tribunal any documents, papers, or records in his possession or control.

16.20: continued

(4) Representation

(a) Appearance. An individual may appear on his own behalf. A duly authorized officer or employee may represent a corporation; an authorized member may represent a partnership or joint venture; and an authorized trustee may represent a trust. Any Party in the public hearing shall have the right to be accompanied, represented and advised by an authorized representative.

(b) Notice of Appearance. An appearance shall be made in the public hearing by filing a written notice with the board of health or Hearing Officer. Such notice shall contain the names, address and telephone number of the authorized representative.

(5) Time

(a) Timely Filing. Papers required or permitted to be filed under 310 CMR 16.20, or any provision of the applicable law must be filed at the board of health office or such other place as the board shall designate within the time limits for such filing as are set by 310 CMR 16.20 or the Hearing Officer. Papers filed in the following manner shall be deemed to be filed as set forth herein:

1. Hand-Delivery during business hours shall be deemed filed on the day delivered.
2. Hand-Delivery during times other than during regular business hours shall be deemed filed on the next regular business day.
3. Mailing in U.S. Mail shall be deemed filed on the date so postmarked.

All papers shall show the date received by the board and the board shall cooperate in giving date receipts to Persons filing papers by hand-delivery.

(b) Notice of Board of Health Actions. Communications concerning public hearings pursuant to these regulations from the board or the Hearing Officer shall be presumably deemed received upon the day of hand-delivery or if mailed three (3) days after deposit in the U.S. mail.

(c) Computation of Time. Unless otherwise specifically provided by law or 310 CMR 16.20, computation of any time period referred to in 310 CMR 16.20 shall begin with the first day following the act which initiates the running of the time period. The last day of the time period so computed is to be included unless it is a Saturday, Sunday, or legal holiday or any other day on which the office of the board is closed, in which event the period shall run until the end of the next following business day. When the time period is less than six (6) days, intervening days when the board is closed shall be excluded in the computation.

(d) Extension of Time. It shall be within the discretion of the board or Hearing Officer, for good cause shown, to extend any time limit contained in 310 CMR 16.20. All requests for extension of time shall be made by motion before the expiration of the original or previously extended time period. This discretion shall not apply to any limitation of the time prescribed by the Massachusetts General Laws.

(6) Filings Generally

(a) Title. Papers filed with a board shall state the report number, the title of the proceeding, the name of the Person in whose behalf the filing is made and the name of the applicant.

(b) Signatures. Papers filed with a board shall be signed and dated by the Party on whose behalf the filing is made or by the Party's Authorized Representative. This signature constitutes a certification by the signer that he has read the document, knows the content thereof, and that such statements are true, that it is not interposed for delay and that if the document has been signed by an Authorized Representative that he has full power and authority to do so.

(c) Form. Size and printing requirements. All Papers, except those submittals and documents which are kept in a larger format during the ordinary course of a Party's business, shall be hand-printed or typewritten on paper 8 to 8 1/2 inches wide, by 11 inches long. Mimeographed, multigraphed, photoduplicated Papers will be accepted as hand-printed or typewritten. All papers shall be clear and legible.

(d) Copies. The original of all Papers shall be filed together with two (2) copies.

16.20: continued

(e) Service. Simultaneously with all filings of any and all Papers with the board, the Party filing such Papers shall send a copy thereof to all other Parties to the proceedings, by delivery in hand, or by United States mail, postage prepaid, properly addressed. All papers filed with the board shall be accompanied by a statement signed under the pains and penalty of perjury that copies have been sent, specifying the mode of service date, the Party to whom sent, the Party's address, and address of service. Failure to comply with this rule shall be grounds for refusal by the board to accept Papers for filing.

Any Party may request a waiver of the requirement of 310 CMR 16.20(6)(e). The Hearing Officer may grant the request if significant expense or waste of resources would be avoided and if adequate arrangements can be made for access to the Papers by all persons who would otherwise be entitled to service of a copy.

(7) Initiation of Hearings.

(a) Commencement. The board shall commence a public hearing pursuant to 310 CMR 16.20 within thirty (30) days of receipt of the Department's Report On Suitability (Report).

(b) Public Notice. At least twenty-one (21) days prior to commencement of the public hearing the board shall cause notice of the public hearing to be published. Such notice shall be published in daily or, if not possible, weekly newspapers of general circulation in the municipality.

(c) Form and Content. The notice shall give the date, time and location of the public hearing, a description of the proposed facility including the type of facility, proposed disposal tonnage, proposed hours of operation, the identity and mailing address of the applicant; the public location within the community and hours where the application may be inspected; the time period for written comment on the application to the board and the address to which comments should be mailed. In addition the notice shall contain the following statement: "The Department of Environmental Quality Engineering has issued a Report in which it determines that the above described place is a suitable place for the proposed facility. Copies of the Department's Report On Suitability and the site suitability criteria (310 CMR 16.00) are available for copying and examination along with the application."

(8) Examination of Record Below; Discovery

(a) Availability of the Record. The Report, the application, and all comments received by the Department on the application are public records and shall be made available by the board for inspection and copying by any person during reasonable business hours. The board may charge reasonable copying fees for any of the documents comprising the record below. There shall be no additional discovery.

(b) Prefiled Direct Testimony. The Hearing Officer may, on his/her own motion, order all Parties to file within a reasonable time in advance of the public hearing full written text of the testimony of their witnesses on direct examination on issues pertinent to site assignment, including all exhibits to be offered into evidence, or on issues specified by the Hearing Officer. Such testimony shall be filed by or before a time specified by the Hearing Officer and shall be available to examination and copying as provided in 310 CMR 16.20(8)(a). The Hearing Officer may also require the filing of written rebuttal testimony within a reasonable time after the filing of the direct testimony described in the preceding sentence. All testimony filed pursuant to this rule shall be subject to the penalties of perjury. All witnesses whose testimony is filed pursuant to this rule shall appear at the hearing on the merits and be available for further examination or cross-examination at the discretion of the Hearing Officer. If a witness is not available for further examination or cross examination at the hearing on the merits, the written testimony of the witness shall be excluded from the record unless the Parties agree otherwise.

(9) Intervention and Participation.

(a) Intervention. Any Person who with good cause wishes to intervene in a

16.20: continued

public hearing shall file a written request (petition) for leave to intervene. Persons whom the Hearing Officer determines are specifically and substantively affected by the hearing shall be allowed to intervene. For the purpose of the Public Hearing the following persons shall be considered to be specifically and substantively affected by the hearing and shall be elgible to register as a Party to the hearing:

1. Abutters. Any abutter or group of abutters to the proposed facility shall be a Party to the hearing by timely submission of a Party Registration Statement in accordance with 310 CMR 16.20(9)(b).
2. Ten Citizens Groups. Any group of ten (10) or more persons may Register collectively as a Party to the public hearing in which damage to the environment as defined in M.G.L. c. 214, s. 7A is or might be at issue; provided, however, that such intervention shall be limited to the issue of the damage to the environment and the elimination or reduction thereof in order that any decision in the public hearing shall include the disposition of such issue.

(b) Registration. The registration of an abutter, group of abutters or ten citizen groups as a Party or the petition of a person to be an intervenor to the public hearing shall be valid only if submitted prior to the commencement of the hearing. The registration statement shall be signed under pains and penalty of perjury and contain the following information:

1. name and address of the registrant(s);
2. proposed party status (abutter, group of abutters, ten citizen group or intervenor);
3. identity of the Authorized Representative, if any;
4. for individuals wishing to register as an abutter a description of the abutting property including its boundaries and current use and a statement that the registrant is the owner of the parcel; and
5. for individuals or groups of individuals petitioning to be an intervenor a statement indicating how they will be substantially and specifically affected by the proposed facility.

If no Authorized Representative is identified in the Registration Statement the first person mentioned in the Statement as a member of the group shall be deemed the Authorized Representative of the group. Said Authorized Representative shall have the sole authority to sign submissions by the group. A group that registers as a Party shall be collectively deemed a Party and shall have the rights of participation of a Party as set forth in 310 CMR 16.20, except as limited by 310 CMR 16.20(9).

(c) Rights of Intervenors. Any person permitted to intervene shall have all rights of, and be subject to, all limitations imposed upon a Party, however, the Hearing Officer may exclude repetitive or irrelevent material. Every Petition intervene shall be treated as a petition in the alternative to participate.

(d) Rights of Participants

1. Any person specifically affected by a proceeding shall be permitted to participate. Permission to participate shall be limited to the right to present testimony, to argue orally at the close of the public hearing and to file a brief. Permission to participate, unless otherwise stated, shall not be deemed to constitute an expression that the person allowed to participate is a party in interest who may be aggrieved by any final decision.
2. Participants shall not be required to submit to cross examination except upon the determination of the Hearing Officer that cross examination is necessary in the interest of a full and fair hearing and an adequate record. Such cross examination of participants shall be conducted through the Hearing Officer. Failure of a Participant to submit to cross examination allowed by the Hearing Officer shall be grounds to strike the Participant's statements.

(10) Conduct of Public Hearing.

(a) Public Hearings, Where Held. Hearings shall be held at a public meeting hall, appropriately sized to accommodate all Parties and the number of persons reasonably anticipated to attend in the city or town where the site is located. The public hearing shall continue until it is closed

16.20: continued

by the Hearing Officer. Arrangements by the board to provide a place for such public meeting shall anticipate that the public hearing may extend for several days.

(b) General. Hearings shall be as informal as may be reasonable and appropriate under the circumstances.

(c) Decorum. All Parties, Authorized Representatives, witnesses and other persons present at the public hearing shall conduct themselves in a manner so as not to obstruct or delay the orderly presentation of evidence and issues. Where such decorum is not observed, the Hearing Officer may take appropriate action.

(d) Hearing Officer. The Hearing Officer shall define issues, receive and consider relevant and reliable evidence and exclude irrelevant evidence, ensure an orderly presentation of the evidence and issues, and aid the board in reaching a decision based on the evidence presented at the hearing and in accordance with the standards set forth in M.G.L. c. 111, s. 150A.

(e) Rights of Parties. All Parties shall have the right to present evidence, cross-examine, make objections and make oral arguments. Cross-examination shall occur immediately after any witness' testimony has been received. Whenever appropriate, the Hearing Officer may permit redirect and recross.

(f) Evidence and Testimony

1. A witness' testimony shall be under oath or affirmation.
2. All evidence and testimony, materials and legal rules on which a decision is to be based must be entered into the Record of the public hearing, unless excluded pursuant to 310 CMR 16.41(8)(b), or (10)(f)3.
3. Witnesses giving testimony shall be available for such further examination or cross examination as is determined to be appropriate by the Hearing Officer. Failure of a witness to be so available may be grounds to strike any other testimony given by such witness from the record at the sole discretion of the Hearing Officer. The Hearing Officer may limit or exclude unduly repetitious or irrelevent evidence. The Report and the Department Record shall not constitute testimony for the purposes of this section.
4. All documents and other evidence offered in evidence shall be open to examination by the Parties.
5. All evidence including any records, investigative reports, documents and stipulations which are to be relied upon in making a decision must be offered and made a part of the Record. Documentary evidence may be in the form of copies or excerpts, or by incorporation by reference.

(g) Administrative Notice. The Hearing Officer or the board of health may take notice of any fact which may be judicially noticed by the courts, and in addition may take notice of general, technical or scientific facts within their specialized knowledge. Parties shall be notified of the material so noticed, and they shall be afforded an opportunity to contest the facts so noticed. The board may utilize their experience, technical competence and specialized knowledge in the evaluation of the evidence presented to them.

(h) Subpoenas. No subpoenas may be issued or enforced requiring the attendance and testimony of a witness or the production of documents at the public hearing.

(i) Transcript of Proceedings.

1. Recording and Transcripts. Testimony and argument at the hearing shall be either recorded electronically or stenographically. Transcripts of the proceedings shall be supplied to any Party, upon request, at his own expense. Any Party, upon motion, may order a stenographer to transcribe the proceedings, at his own expense. In such event, a stenographic record shall be provided to the board or Hearing Officer at no expense to the board, and upon such other terms as the board or Hearing Officer shall order.

(j) Contents of Record. The record of the proceedings shall include the Department's Report On Suitability and accompanying Record, the Department of Public Health report, if any, and shall in addition, consist of the following items appropriate to the hearing: pleadings, prehearing conference memoranda, magnetic tapes, orders, briefs, and memoranda, transcripts, exhibits and other papers or documents which the Hearing Officer has specifically designated be made part of the record.

16.20: continued

(k) Decision.

1. Time of Decision. The board shall render its decision within forty-five (45) days of the initial date of the public hearing.

2. Standard of Decision. A board shall determine that a site is suitable for assignment as a site for a new or expanded solid waste facility unless it makes a finding, based on the siting criteria as set forth in 310 CMR 16.40, that the siting thereof would constitute a danger to the public health, safety or environment. If such a finding is made the site shall be determined to be not suitable and shall not be assigned.

3. Tentative Decisions. Tentative decisions shall not be issued as a matter of routine, but shall be issued only if a Party requests a tentative decision either in writing or orally on the record, prior to the close of the hearing on the merits; or if the board determines that a tentative decision should be issued in the interest of justice. Every tentative decision shall be in writing and shall be signed by a majority of those officials of the board who rendered the decision. Every tentative decision shall contain a statement of the reasons therefor, including a determination of fact pertaining to each of the site suitability criteria listed in 310 CMR 16.40 or law necessary to the decision. If the majority of the board who must sign the final decision have personally heard or read the evidence, the board shall not be required to comply with a request to issue a tentative decision.

4. Final Decision. Every final decision shall be in writing and shall be signed by a majority of those officials of the board who rendered the decision. Every final decision shall contain a statement of the reasons therefore, including a determination of fact pertaining to each of the site suitability criteria listed in 310 CMR 16.40 or law necessary to the decision, provided that if a final decision was preceded by a tentative decision, the final decisions may incorporate by reference those determinations set forth in the tentative decision, subject to such modifications and discussion as the Hearing Officer or board may deem appropriate to respond to timely filed opposing and concurring views with the tentative decision.

(11) Selection and Qualification of Hearing Officer

(a) The Hearing Officer shall be selected by majority vote of the board of health.

(b) The person selected to be the Hearing Officer shall be impartial and have the requesite qualifications to properly perform the duties and responsibilities of a Hearing Officer. Except as agreed to by the Parties and a majority of the board of health, no person shall be a Hearing Officer who:

1. is related to any board member, party, abutter, or applicant;

2. is a current or former employee or agent of the applicant or of the municipality where the proposed site is located prior to selection as Hearing Officer. Notwithstanding the aforesaid, a person who has previously served as a Hearing Officer is not excluded from subsequent service as a Hearing Officer;

3. has a personal financial interest or at the time of selection or at any time during the proceedings be employed by any person having a financial interest in the board's decision on site suitability; or

4. does not have experience by training or practice in conducting administrative or judicial proceeding's.

(c) Duties. The Hearing Officer's duties shall include:

1. opening and closing the hearing;

2. establishing the order of the proceedings;

3. ensuring that only reliable and relevant testimony is introduced;

4. assisting all those giving testimony to make a full and free statement of the facts in order to bring all information necessary to determine whether a site is suitable or not suitable;

5. ensuring that all Parties have an opportunity to present their claims orally or in writing and to present witnesses and evidence relevant to the suitability or non-suitability of the site;

6. ensuring that participants have an opportunity to present evidence, whether orally or in writing, relevant to the suitability or non-suitability of a site;

16.20: continued

7. introducing into the record any regulations, statutes, memoranda or other materials he believes relevant to the issues at the proceeding;
8. receiving, ruling on, limiting or excluding evidence pursuant to 310 CMR 16.41(10)(f) below; and
9. establishing a date and time following the close of hearing until which time written evidence will be received, considered and made part of the record.

Where procedural issues arise regarding the conduct of the hearing which are not governed by 310 CMR 16.20 the Hearing Officer may rely on the "Standard Adjudicatory Rules of Practice and Procedure", 801 CMR 1.01, to resolve such issues.

(d) Powers. The Hearing Officer's powers shall include the authority to:
1. request a statement of the issue or issues and define the relevant issues;
2. regulate the presentation of the evidence and the participation of the Parties or their representatives, or the participation of other Persons, for the purpose of ensuring an adequate and comprehensible record of the proceedings. To this end the Hearing Officer may conduct his own examination of witnesses, may require that all examination or cross examination of witnesses be directed through the Hearing Officer, through some other person, or by any other means or method of examination or cross examination of witnesses as he determines is appropriate to ensure full examination of the issues; and
3. regulate the presentation of the evidence and the participation of the Parties or their representative or the participation of other Persons for the purpose of ensuring that the public hearing is concluded in a timely manner to allow the board to render a written decision within forty-five (45) days of the commencement date of the public hearing. To this end the Hearing Officer shall impose such time restrictions and limitations on oral presentations as he deems appropriate.

(12) Imposition of Conditions

(a) The board may include in any decision to grant a site assignment such limitations with respect to the extent, character and nature of the facility or expansion thereof, as may be necessary to ensure that the facility or expansion thereof will not present a threat to the public health, safety or the environment.

(13) Notice of Decision.

(a) Incorporation into the Record. Upon its issuance, the decision shall be incorporated into the Record and made available for inspection and copying as set forth in 310 CMR 16.20(8)(a).

(b) Time of Notice. Within seven (7) days of issuance of its decision the board shall publish notice of its decision in the same manner as set forth in 310 CMR 16.20(7)(b).

(c) Content of Notice. The nature of decision shall identify the applicant, briefly describe the proposed facility, including its location, and set forth the board determination. The notice shall include the following provision: "Any person aggrieved by the decision of the board of health may, within thirty (30) days of publication of this Notice of Decision appeal under the provisions of M.G.L. c. 30A, s. 14."

(16.21-16.29: Reserved)

PART III: APPLICATION FEE

16.30: Fees

(1) Application Fees

(a) General. The Application Fee is a fee which is paid by an applicant to the board of health. The board of health may use the fee for eligible costs of reviewing technical data, obtaining technical assistance and conducting a public hearing. The Application Fee shall be assessed as two separate fees:
1. Technical Fee; and
2. Public Hearing Fee.

16.30: continued

(b) Excess Fees. The board of health shall return to the applicant any of the Application Fee in excess of the actual expenditures for allowable costs following the completion of the site assignment process.

(c) Alternative Systems. The board of health may establish, in lieu of part or all of this section 310 CMR 16.30, another system for the assessment and payment of an Application Fee provided such system is agreed to by the applicant.

(d) Nothing in this section, 310 CMR 16.30, creates or modifies any rights of boards of health relative to the assessment or collection of fees under applicable statutes, by-laws, or ordinances governing municipal finance.

(2) Technical Fee.

(a) General. The Technical Fee may be used by the board of health to cover the cost of conducting a review of technical data and/or to cover a portion of the cost of other technical assistance.

(b) Assessment of Fee.

1. Assessment. The board of health, upon the receipt of an application, may assess by a written notice to the applicant a Technical Fee for said application not to exceed the maximum amount set forth in 310 CMR 16.99.

2. Form of Payment. The board shall prescribe the amount of the fee and the manner of payment in writing to the applicant within ten (10) days of the filing of the application in accordance with 310 CMR 16.08.

3. Payment. The applicant shall pay the Technical Fee in the amount and manner prescribed by the board of health. In the absence of such prescription, the applicant may satisify the Technical Fee payment requirements for the purposes of 310 CMR 16.10(3) by making a payment in the form of a certified or bank check or money order, in an amount equal to the maximum Technical Fee for the appropriate facility as specified in 310 CMR 16.99.

4. Waiver. The board of health may waive all or a portion of the Technical Fee.

(c) Technical Review

1. General. The Technical Fee may be expended for one hundred percent (100%) of the allowable cost of reviewing technical data submitted to the board of health.

2. Allowable costs. Allowable costs for technical review include the cost of hiring consultants and related technical experts to assist the board of health in reviewing the application, the Department Report on Suitability, the Department of Public Health's Report and comments, public comments and any subsequent amendments or additions to the application.

3. Allowable tasks. Allowable tasks for the consultants and related technical experts include:

a. determining completeness and accuracy of data in the application;

b. determining whether the correct analytical techniques were used, whether valid data were obtained, and whether the data support the proposed conclusions;

c. determining what other data should be obtained, the means to obtain it and its potential significance;

d. examining municipal, Department and other relevant records and consulting with Department staff;

e. visiting the site to make a visual inspection;

f. preparing and submitting comments to the Department on technical issues relating to the site and the site suitability criteria;

g. reviewing the Department Report on Suitability and other data submitted prior to and during the hearing; and

h. preparing a written report of comments and determinations.

4. Excluded Costs. Allowable costs for technical review shall not include the cost of conducting site, environmental or population sampling and analyses, otherwise generating new data, or performing independent analyses of environmental health impacts. These costs may qualify as allowable costs for technical assistance in accordance with 310 CMR 16.30(d)2.

16.30: continued

(d) Technical Assistance

1. General. The Technical Fee may cover fifty percent (50%) of the cost of providing expert legal, scientific or engineering assistance to the board of health to assure that all points of view are adequately presented and evaluated at the public hearing.

2. Allowable costs. Allowable costs for technical assistance include the cost of hiring consultants, technical experts or legal counsel. Allowable types of technical assistance include:

a. legal counsel to represent the board of health at the hearing and to examine witnesses at the hearing;

b. scientific and/or engineering experts to help develop evidence, question witnesses and/or testify at the hearing; and

c. photographic or graphic expertise.

(e) Extraordinary Expenses

1. Assessment. After commencement of the public hearing, pursuant to the requirements of 310 CMR 16.20, the board of health may assess in writing, an additional Technical Fee payment when the following conditions are satisified:

a. the evidence proposed to be obtained by the expenditure of the fee is likely to be critical to the determination of site suitability; and

b. the applicant has failed to provide such evidence upon request by the Hearing Officer; and

c. the evidence cannot be acquired without the expenditure by the board of health of funds in excess of the Technical Fee; and

d. the evidence did not exist or was not reasonably discoverable through due diligence by the board of health prior to the request; or

e. the evidence is based on new scientific or technical standards or criteria which were previously unavailable.

2. Payment or Appeal. The applicant upon receipt of the written request may:

a. within three (3) days appeal to the Hearing Officer for a determination as to the appropriateness and reasonableness of the fee assessment; or

b. make the appropriate payment as prescribed by the board of health within ten (10) days.

3. Hearing Officer's Decision on Appeals.

a. Standard of Decision. The Hearing Officer shall determine that an extraordinary expense request is reasonable only if she or he finds that the conditions in 16.30(2)(e)1 are satisfied.

b. Decision by the Hearing Officer. The Hearing Officer shall issue a written determination to the applicant and the board of health. When the Hearing Officer determines the assessment is reasonable the applicant shall make the appropriate payment as directed by the board of health within six (6) days. When the Hearing Officer determines the assessment is not reasonable the applicant shall not be required to make the payment.

4. Non-payment. The board of health may withhold final disposition of the site assignment application until the applicant submits the payment or issue a determination based on the available information.

(3) Public Hearing Fee

(a) General. The board of health may use the Public Hearing Fee to cover the cost of conducting a public hearing that meets the requirements of 310 CMR 16.20.

(b) Assessment and Payment of the Public Hearing Fee. The board of health, upon the receipt of a Department Report on suitability that contains a finding that a site is suitable, may assess a Public Hearing Fee.

1. Initial Public Hearing Fee Assessment.

a. Assessment. The board of health shall prescribe to the applicant in writing the amount and manner of payment of the initial public hearing fee assessment.

b. Maximum Amount. The maximum amount of the initial assessment shall be fifty percent (50%) of the maximum allowable Technical Fee for the appropriate size and type of facility, as set in 310 CMR 16.99.

16.30: continued

c. Payment. The applicant shall pay the initial public hearing fee assessment as prescribed by the board of health within fifteen (15) days of receipt of the written request from the board.

2. Additional Public Hearing Fee Assessments.

a. General. In the event that the initial Public Hearing Fee assessment is insufficient to cover the allowable costs described in 310 CMR 16.30(3)(d) the board of health may require additional Public Hearing Fee payments.

b. Assessment. The board of health shall prescribe to the applicant, in writing, the amount and manner of payment of the additional public hearing fee assessments.

c. Payment. The applicant shall pay the additonal assessment within six (6) days of receipt of the written request from the board of health.

3. Fee Waiver. The board of health may waive all or a portion of the Public Hearing Fee.

(c) Non-payment of Fees

1. Suspension of Hearings. In the event that any fee assessment is not paid as required, the board of health may suspend the public hearing, or, in the case of the initial payment, delay the opening of the public hearing.

2. Resumption of Hearings. Any hearing delayed or suspended because of non-payment of fees shall be commenced or resumed within seven (7) days of receipt of payment or resolution of a fee dispute in accordance with 310 CMR 16.30(6).

3. Exception. When the applicant is the municipality itself or an agency thereof, the public hearing shall not be delayed or suspended because of non-payment of any public hearing fee assessment.

(d) Allowable Costs. The only allowable costs that may be paid from the Public Hearing Fee are:

1. the cost of any notice required under 310 CMR 16.20;
2. the cost of recording, through a stenographic record, tape recording, or other means as determined by the Hearing Officer the record of the proceedings;
3. the cost of having a Hearing Officer perform the duties set forth in 310 CMR 16.20;
4. the cost of producing any copies required under 310 CMR 16.20; and
5. the cost of renting a hall, chairs and/or public address system when the municipality has no such facilities or equipment which are adequate for the purpose of the public hearing.

Transcription of the proceedings shall not be paid for from the Hearing Fee except by order of the Hearing Officer prior to a final decision on site assignment by the board of health. The cost of transcribing or otherwise preparing an official transcript for appeal shall not be paid by the Public Hearing Fee.

(4) Expenditure of the Application Fee

(a) General. All expenditures of the Application Fee shall be reasonable. The amount paid for any service shall not exceed the usual and customary amount for such service.

(b) Obligation of Funds. The board of health shall not spend or enter into obligations to spend any or all of the Technical Fee without a scope of work. The scope of work shall detail proposed contractor's services and include cost estimates for each service and describe whether the proposed service is for technical review or technical assistance.

(c) Record Keeping. The board of health shall make and retain or require all persons paid from the Application Fee to make and retain written records which set forth:

1. a description of each of the services performed and work products developed; and
2. the amount expended for each such service or work product.

(d) Production of Records. The board of health, upon written request from the applicant, the Hearing Officer or the Department, shall provide or cause their contractor to provide, within a reasonable time not to exceed fourteen (14) days, a copy of said records.

16.30: continued

(e) Cessation of Expenditures. The board of health shall not spend any additional amount of the Application Fee and shall make reasonable efforts to halt all work on any activities that would be covered by the Application Fee, when the board of health receives either:

1. a Department Report on Suitability that finds a site not suitable; or
2. a notice from the applicant withdrawing the application from consideration.

(5) Reimbursement of Unexpended Fees

(a) Request for Reimbursement. After a final decision on the application or upon the withdrawal of an application, the applicant may submit a written request to the board of health to provide a final accounting of all funds expended or owed from the Application Fee and to return all unexpended and uncommitted funds. For the purpose of this section, a final decision shall be either:

1. the Department Report on Suitability finding a site to be not suitable; or
2. a determination by the board of health to assign a site or to refuse to assign a site after a public hearing.

(b) Accounting. The board of health shall provide a full accounting of all expenditures within forty-five (45) days of receipt of the request.

(c) Reimbursment. The board of health shall return the unencumbered funds within a reasonable time period.

(6) Fee Disputes

(a) The board of health shall expend and, if applicable, reimburse to the applicant all fees in accordance with the requirements of 310 CMR 16.30.

(b) Any claims by the applicant against the board of health for improper disposition of fees shall be adjudicated in a court of competent jurisdiction or, if mutually agreed upon by the parties, by arbitration or mediation.

(16.31-16.39: Reserved)

PART IV: SITE SUITABILITY CRITERIA

Preamble

The following section of the regulations establish the criteria and decision making process the Department shall utilize in determining whether a site is suitable for a proposed solid waste management facility and upon which boards of health must base a determination to grant or refuse to grant a site assignment.

16.40: Site Suitability Criteria

(1) Determination of Suitability.

(a) Department's Determination. The Department shall determine whether a site for a new or expanded facility of the type and scope proposed is suitable or not suitable based upon the criteria set forth in 310 CMR 16.40(3), (4) and (5). No site shall be deemed to be suitable where the solid waste management activities will constitute a danger to public health or safety or the environment. In determining whether or not a proposed facility at a specified site meets the criteria, the Department shall:

1. determine whether the facility is located within a restricted area;
2. apply in "non-restricted areas" such state and federal standards, criteria, guidelines or allowable limits and written health policies which are intended to protect the public health, safety, and the environment, or where such protective limits have not been adopted, the Department shall evaluate the potential for an adverse impact on a facility/site specific basis;
3. consider whether the site is in a preferred municipality as defined herein; and
4. consider whether the site use promotes integrated solid waste management in accordance with 310 CMR 16.40.

16.40: continued

(b) Site Assignment by Boards of Health. The board of health shall assign a place requested by an applicant as a site for a new facility or the expansion of an existing facility unless it makes a finding, based on the decision process set forth at 310 CMR 16.40(1)(a) that the siting thereof would constitute a danger to the public health, safety, and environment. The board of health shall not impose any condition pertaining to facility design except in accordance with conditions placed by the Department pursuant to 310 CMR 16.40(1)(c)3.

(c) Facility Design Review.

1. General. All applications shall be evaluated with the presumption that the proposed facility shall be designed and constructed to meet all relevant state and federal statutory, regulatory and policy requirements.

2. Design Considerations. The review of an application shall not consider detailed facility designs or operations except where:

a. the Department determines that specific design or operation plans or data are necessary to determine whether potential discharges or emissions from the proposed facility could render the site not suitable and requires the applicant to submit such relevant and detailed information; or

b. the applicant intends to alter the site or design the facility to meet specific site suitability criteria and submits such plans or other information as the Department deems necessary to determine if the criteria are satisfied.

3. Design Conditions. When facility design or operation plans are submitted the Department may base a site suitability determination on:

a. the incorporation of specific facility design elements; or

b. compliance with performance and technical standards and criteria.

(2) Application of the Site Suitability Criteria. Facility specific site suitability criteria are set forth in 310 CMR 16.40(3) for each of the following types of solid waste management facilities:

(a) sanitary landfills;
(b) single waste landfills (Reserved)
(c) solid waste combustion facilities; and
(d) solid waste handling and processing facilities.

Generally applicable criteria are set forth in 310 CMR 16.40(4) and apply equally to all types of solid waste management facilities.

(3) Facility Specific Site Suitability Criteria

(a) Criteria for Sanitary Landfill Facilities. No site shall be determined to be Suitable or be assigned as a sanitary landfill facility where:

1. any area of waste deposition would be within a Zone II area of an existing public water supply well;

2. any area of waste deposition would be within the Interim Wellhead Protection Area (IWPA); the proponent may conduct a preliminary Zone II study, approved of by the Department, to determine if the waste deposition area would be beyond the Zone II of the public water supply well in question;

3. any area of waste deposition would be within fifteen thousand (15,000) feet upgradient of the existing well for which a Zone II has not been calculated; the proponent may conduct a preliminary Zone II study, approved of by the Department, to determine if the waste deposition area would be beyond the Zone II of the public water supply well in question;

4. the area of waste deposition would be within a Zone II of a potential public ground water supply;

5. it is determined by the Department that a discharge from the area of waste deposition would pose a danger to a potential public ground water supply for which a Zone II has not been determined;

6. any area of waste deposition would be over the recharge area of a Sole Source Aquifer, unless:

a. there are no existing or potential public ground water supplies downgradient of the site;

16.40: continued

b. there are no existing or potential private water supplies downgradient of the site; however, the applicant may have the option of providing an alternative public water supply to replace all the existing or potential downgradient private ground water supplies; and

c. there exists a sufficient existing or potential public water supply to meet the municipality's projected needs;

7. any area of waste deposition is less than one-half mile upgradient of a surface drinking water supply as defined by groundwater flow or surface water drainage;

8. any area of waste deposition would be less than 250 feet upgradient, as defined by groundwater flow or surface water drainage, of a perennial water course that drains to a surface drinking water supply which is within one (1) mile of the waste deposition area;

9. any area of waste deposition is less than 500 feet downgradient of a surface drinking water supply as defined by groundwater flow or surface water drainage;

10. any area of waste deposition would be within 500 feet of a private drinking water supply well existing or established as a potential supply at the time of submittal of the application; provided, however, the applicant may show a valid option to purchase the restricted area, including the well and a guarantee not to use the well as a drinking supply, the exercise of which shall be a condition of any site assignment;

11. the maximum high groundwater table is within four (4) feet of the ground surface in areas where waste deposition is to occur unless it is demonstrated that a four (4) foot separation between the bottom of the lower most liner and the maximum high groundwater level can be designed to the satisfaction of the Department;

12. the outermost limits of waste deposition or leachate containment structures would be within an area protected by the Wetlands Protection Act, M.G.L. c. 131, s. 40, including the 100 year floodplain;

13. any area of waste deposition or the leachate containment structures would be less than 250 feet to a lake or river (not including a stream) as defined in 310 CMR 10.00, other than a drinking water supply; or

14. any area of waste deposition is less than 500 feet to an occupied residential dwelling, bedded health care facility, prison, lower educational institution or children's pre-school, excluding equipment storage or maintenance structures; provided, however, the applicant may show a valid option to purchase the potentially affected property, the exercise of which shall be a condition of any site assignment.

(b) Criteria for Single Waste Landfills (Reserved)

(c) Criteria for Solid Waste Combustion Facilities. No site shall be determined to be suitable or be assigned as a solid waste combustion facility where:

1. a waste handling or processing area is within a Interim Wellhead Protection Area (IWPA) or Zone II of an existing public water supply or Interim Wellhead Protection Area (IWPA)or the Zone II of a potential public drinking water groundwater source unless:

a. a determination has been made that the facility cannot be sited outside the IWPA or Zone II; or

b. there would be a net environmental benefit to the ground water by siting the facility within the Zone II or the IWPA and necessary restrictions are imposed to minimize the risk of an adverse impact to the groundwater.

2. the waste handling or processing area is less than 500 feet upgradient of a surface drinking water supply as defined by groundwater flow or surface water drainage;

3. the waste handling or processing area is less than 250 downgradient to a surface drinking water supply as defined by groundwater flow or surface water drainage;

4. the waste handling or processing area is within 250 feet of a existing or potential private drinking water supply well, provided, the applicant may show a valid option to purchase the restricted area including the well and a guarantee not to use the well as a drinking water source, the exercise of which shall be a condition of any site assignment.

16.40: continued

5. the maximum high groundwater table is within two (2) feet of the ground surface in areas where waste processing and handling is to occur unless it is demonstrated that a two (2) foot separation can be designed to the satisfaction of the Department; or

6. the waste handling or processing area is within 500 feet of an occupied residential dwelling, prison, bedded health care facility, lower educational institution or children's pre-school, excluding equipment storage or maintenance structures; provided, however, the applicant may show a valid option to purchase the potentially affected property, the exercise of which shall be a condition of any site assignment.

(d) Criteria for Handling and Processing Facilities. No site shall be determined to be suitable or be assigned as a solid waste handling and processing facility where:

1. a waste handling or processing area is within a Interim Wellhead Protection Area (IWPA) or a Zone II of an existing public water supply well or a potential public water supply groundwater source, unless:

a. a determination has been made that the facility cannot reasonably be located outside the IWPA or Zone II; or

b. if the site has been previously used for solid waste management activities that there would be a net environmental benefit to the groundwater by siting the facility within the Zone II or IWPA: and

c. necessary restrictions are imposed to minimize the risk of adverse impact to the groundwater.

2. the waste handling or processing area is less than 500 feet upgradient of a surface drinking water supply as defined by groundwater flow or surface water drainage;

3. the waste handling or processing area is less than 250 feet downgradient to a surface drinking water supply as defined by groundwater flow or surface water drainage;

4. the waste handling or processing area is within 250 feet of an existing or potential private drinking water supply well, provided, the applicant may show a valid option to purchase the restricted area including the well and a guarantee not to use the well and drinking water the exercise of which shall be a condition of any site assignment.

5. the maximum high groundwater table is within two (2) feet of the groundwater surface in areas where waste handling or processing is to occur unless it can be demonstrated that a two (2) foot separation can be design and operated to the satisfaction of the Department; or

6. the waste handling or processing area is within 250 feet of an occupied residential dwelling, prison, bedded health care facility, lower educational institution or children's pre-school, excluding equipment storage or maintenance structures provided, however, that the applicant may show a valid option to purchase the restricted area, the exercise of which shall be a condition of any site assignment.

(4) General Site Suitability Criteria. The following Site Suitability Criteria shall apply to all types of solid waste management facilities.

(a) Agricultural Lands. No site shall be determined to be suitable or be assigned as a solid waste management facility where a 100 foot buffer would not be present between the site assigned area and active farmland.

(b) Traffic and Access to the Site. No site shall be determined to be suitable or be assigned as a solid waste management facility where traffic impacts from the facility operation would constitute a danger to the public health, safety, or the environment taking into consideration the following factors:

1. traffic congestion;
2. pedestrian and vehicular safety;
3. road configurations;
4. alternate routes; and
5. vehicle emissions

(c) Wildlife and Wildlife Habitat. No site shall be determined to be suitable or be assigned as a solid waste management facility where such siting would:

1. have an adverse impact on Endangered, Threatened, or Special Concern species listed by the Natural Heritage and Endangered Species Program of the Division of Fisheries and Wildlife in its database:

16.40: continued

2. have an adverse impact on an Ecologically Significant Natural Community as documented by the Natural Heritage and Endangered Species Program in its database; or

3. have an adverse impact on the wildlife habitat of any state Wildlife Management Area.

(d) Areas of Critical Environmental Concern. No site shall be determined to be suitable or be assigned as a solid waste management facility where such siting:

1. would be located within an Area of Critical Environmental Concern (ACEC), as designated by the Secretary of the Executive Office of Environmental Affairs; or

2. would fail to protect the outstanding resources of an ACEC as identified in the Secretary's designation if the solid waste management facility is to be located outside, but adjacent to the ACEC.

(e) Potential Air Quality Impacts. No site shall be determined to be suitable or be assigned as a solid waste management facility where the anticipated emissions from the facility would not meet required state and federal air quality standards or criteria or would otherwise constitute a danger to the public health, safety or the environment, taking into consideration:

1. the concentration and dispersion of emissions
2. the number and proximity of sensitive receptors; and
3. the attainment status of the area.

(f) Potential for the Creation of Nuisances. No site shall be determined to be suitable or be assigned as a solid waste management facility where the establishment or operation of the facility would result in nuisance conditions which would constitute a danger to the public health, safety or the environment taking into consideration the following factors:

1. noise;
2. litter;
3. vermin such as rodents and insects;
4. odors;
5. bird hazards to air traffic; and
6. other nuisance problems.

(g) Size of Facility. No site shall be determined to be suitable or be assigned as a solid waste management facility if the size of the proposed site is insufficient to properly operate and maintain the proposed facility.

(h) Areas Previously Used for Solid Waste Disposal. Where an area adjacent to the site of a proposed facility has been previously used for solid waste disposal the following factors shall be considered by the Department in determining whether a site is suitable and by the board of health in determining whether to assign a site:

1. the nature and extent to which the prior solid waste activities on the adjacent site currently adversely impact or threaten to adversely impact the proposed site;

2. the nature and extent to which the proposed site may impact the site previously used for solid waste disposal; and

3. the nature and extent to which the combined impacts of the proposed site and the previously used adjacent site adversely impact on the public health, safety and the environment; taking into consideration:

a. whether the proposed site is an expansion of or constitutes beneficial integration of the solid waste activities with the adjacent site;

b. whether the proposed facility is related to the closure and/or remedial activities at the adjacent site; and

c. the extent to which the design and operation of the proposed facility will mitigate existing or potential impacts from the adjacent site.

(i) Existing Facilities.

1. In evaluating proposed sites for new solid waste management facilities the Department and the board of health shall give preferential consideration to sites located in municipalities in which no existing sanitary landfill or solid waste combustion facilities are located. This preference shall be applied only to new facilities which will not be for

16.40: continued

the exclusive use of the municipality in which the site is located. The Department and the board of health shall weigh such preference against the following considerations when the proposed site is located in a community with an existing disposal facility:

a. the extent to which the municipality's or region's solid waste needs will be met by the proposed facility; and

b. the extent to which the proposed facility incorporates recycling, composting or waste diversion activities.

2. Where an existing disposal facility and a proposed new disposal facility in a municipality each are designed to accept three hundred tons per day (300 TPD) or more the Department and the board of health shall consider whether the cumulative impacts of the proposed facility and the documented impacts of the existing disposal facility constitutes a danger to public health, safety or the environment, taking into consideration whether the proposed facility is related to the closure and/or remedial activities at the existing disposal facility.

(j) Regional Participation. The Department and the board of health shall give preferential consideration to sites located in municipalities not participating in a regional disposal facility. The Department and the board of health shall weigh such preference against the following considerations when the proposed site is located in a community participating in a regional disposal facility:

1. the extent to which the proposed facility meets the municipality's and the region's solid waste management needs; and

2. the extent to which the proposed facility incorporates recycling, composting, or waste diversion activities.

(5) Promotion of Integrated Solid Waste Management

(a) In determining whether a site is suitable the Department shall consider the extent to which the proposed facility is consistent with or integrated into the statewide plan adopted pursuant to M.G.L. c. 16, s. 22.

(b) In determining whether a site is suitable the Department and the board of health shall consider the extent to which the proposed use of the site directly incorporates recycling and composting techniques or is otherwise integrated into recycling and composting activities for the proposed facility's service area.

(c) A site proposed for a combustion facility or a landfill shall be reviewed to determine if the site is also suitable for a recycling or composting facility either in conjunction with or instead of the proposed facility.

(d) Site assignment applications which incorporate significant recycling or composting uses, in accordance with the goals of the statewide plan, shall receive preferred consideration. Such consideration may include, without limitation:

1. approval of a facility in a non-preferred municipality as set forth at 310 CMR 16.40(4)(i) and (j); or

2. consideration of a waiver application as set forth in 310 CMR 16.40(6)

(6) Waiver

(a) General. The Commissioner may waive any criteria contained in 310 CMR 16.40(3) not specifically required by law when the Commissioner finds that strict compliance with such criteria would result in undue hardship and would not serve to minimize or avoid adverse impact. Hardship based on delay in compliance by the proponent, increased facility construction costs or reduced facility revenue generation will not be sufficient, except in extraordinary circumstances, to invoke this section.

(b) Criteria. A waiver shall not be granted unless the Commissioner determines that the granting of a waiver is necessary to accomodate an overriding community, regional, or state public interest and the granting of the waiver would not diminish the level of protection to public health and safety and the environment that will exist in the absence of the waiver.

(c) Considerations. In determining whether a waiver should be granted, the Commissioner shall consider, in addition to the criteria contained in 310 CMR 16.40(6)(b) the following factors:

1. the availability of other suitable sites in the affected municipality or regional district;

16.40: continued

2. whether the site is in a preferred municipality as defined in M.G.L. c. 111, s. 150A1/2;
3. the minimum facility size required to reasonably meet essential waste handling activities;
4. whether the waiver will result in environmental benefits in excess of those that could be achieved in the absence of the waiver;
5. the extent to which the proposed facility is part of an integrated solid waste management activity; and
6. whether the solid waste management objectives of the proposed project could be achieved in the absence of the waiver.

(d) Filings. All requests for waivers shall be filed and documented in accordance with section 310 CMR 16.08(5)(c).

(16.41 - 16.98: Reserved)

16.99: APPENDIX A

TECHNICAL FEE

The board of health shall assess the Technical Fee based on the type and size of facility or site stated on the application.

The maximum allowable Technical Fee that the board of health may assess shall be computed using the appropriate table for each type of facility.

TABLE 1. MAXIMUM TECHNICAL FEE FOR LANDFILLS

The maximum amount of the Technical Fee for a landfill is computed on the basis of the total area of the site specified in the application.

Size (acres)	Maximum Fee ($)
0-10	$15,000
10-25	$15,000 plus $1,000 for each acre in excess of 10
over 25	$30,000 plus $ 200 for each acre in excess of 25

TABLE 2. MAXIMUM TECHNICAL FEE FOR TRANSFER STATIONS

The maximum amount of the Technical Fee for a transfer station is computed on the basis of the maximum daily volume of waste (measured in tons per day) proposed to be processed as specified in the application as follows:

Maximum Fee = $3000 + [$20 x Daily Volume (tons/day)]

TABLE 3. MAXIMUM TECHNICAL FEE FOR WASTE COMBUSTION FACILITIES

The maximum amount of the Technical Fee for a waste combustion facility is computed on the basis of the maximum daily volume of waste (measured in tons per day) proposed to be processed as specified in the application as follows:

Maximum Fee = $25000 + [$10 x Daily Volume (tons/day)]

TABLE 4. MAXIMUM TECHNICAL FEE FOR RECYCLING FACILITIES

The maximum amount of the Technical Fee for a recycling facility is computed on the basis of the maximum daily volume of waste (measured in tons per day) proposed to be processed as specified in the application as follows:

Maximum Fee = $3000 + [$20 x Daily Volume (tons/day)]

TABLE 5. MAXIMUM TECHNICAL FEE FOR COMPOSTING FACILITIES

The maximum amount of the Technical Fee for a composting facility is computed on the basis of the maximum daily volume of waste (measured in tons per day) proposed to be processed as specified in the application as follows:

Maximum Fee = $3000 + [$20 x Daily Volume (tons/day)]

ADJUSTMENT OF TECHNICAL FEE FOR INFLATION

The maximum allowable technical fee may be adjusted for inflation using the following formula:

MTF (current year) = MTF (1988) x I (current year) /I (1988)
Where:
MTF (1988) = Maximum Technical Fee Computed using table 1,2,3,4,or 5 above for the specific facility under consideration
MTF (current year) = Maximum Technical Fee for the current year
I (1988) = Index for 1988
I (current year) = Index for the current year
Index is the Construction News Record construction Index.

REGULATORY AUTHORITY

310 CMR 16.00: M.G.L. c. 21A, ss. 2 and 8; c. 21, s. 27; c. 111, ss. 150A and 150A 1/2.

310 CMR 17.00 is RESERVED for future use.

APPENDIX D

Examples of Local Bylaws

Draft - TOWN OF HADLEY

AQUIFER PROTECTION DISTRICT

Add to Section II-A. Types of Districts
Aquifer Protection

Add new Section XI - SPECIAL DISTRICTS
IV-A Aquifer Protection District

1. Purpose of District

To promote the health, safety and welfare of the community by protecting and preserving the surface and groundwater resources of the town from any use of land or buildings which may reduce the quality or quantity of its water resources.

2. Definitions

a. Aquifer: Geologic formation composed of rock or sand and gravel that contains significant amounts of potentially recoverable potable water;

b. Groundwater: All the water found beneath the surface of the ground;

c. Hazardous Waste: A waste which is hazardous to human health or the environment. Hazardous wastes have been designated by the U.S. Environmental Protection Agency under 40 CFR 250 and the Regulations of the Massachusetts Hazardous Waste Management Act, Massachusetts General Laws Chapter 21C.

d. Impervious Surfaces: Materials or structures on or above the ground that do not allow precipitation to infiltrate the underlying soil;

e. Leachable Wastes: Waste materials including solid wastes, sludge and pesticide and fertilizer wastes capable of releasing water-borne contaminants to the environment;

f. Primary Aquifer Recharge Area: Areas which are underlain by surficial geologic deposits including glaciofluvial or lacustrine stratified drift deposits or alluvium or swamp deposits, and in which the prevailing direction of groundwater flow is toward water supply wells.

g. Secondary Aquifer Recharge Area: Areas which are underlain by surficial geologic deposits of primarily till, and in which the prevailing direction of groundwater flow is toward water supply wells.

3. Scope of Authority

The Water Supply Protection District is an overlay district and shall be superimposed on the other districts established by the bylaw. All uses, dimensional requirements and other provisions of the Town of Hadley Zoning Bylaw applicable to such underlying districts shall remain in force and effect, except that where the Water Supply Protection District imposes greater or additional restrictions and requirements, such restrictions or requirements shall prevail. Any uses not permitted in underlying districts shall remain prohibited.

4. Establishment of District

The Aquifer Protection District is herein established to include all specified lands within the Town of Hadley. The intent of the Aquifer Protection District is to include lands lying within the primary and secondary recharge areas of groundwater aquifers. The map entitled "Aquifer Protection District, Town of Hadley" on file with the Town Clerk, delineates the boundaries of the district.

Where the bounds delineated are in doubt or in dispute, the burden of proof shall be upon the owner(s) of the land in question to show where they should be properly located. At the request of the owner(s), the Town may engage a professional hydrogeologist to determine more accurately the location and extent of an aquifer, primary and secondary recharge area and may charge the owner(s) for all or part of the cost of the investigation.

5. Prohibited Uses

a. Business and industrial uses, not agricultural, which manufacture, process, store or dispose of hazardous wastes in amounts exceeding the minimum threshold amount requiring compliance with Massachusetts Department of Environmental Quality Engineering hazardous waste regulations 310 CMR 30;

b. Trucking or bus terminals, motor vehicle gasoline sales, motor vehicle service and repair shops, car washes;

c. Wood preserving and furniture stripping;

d. Solid waste landfills, dumps, junk and salvage yards, with the exception of the disposal of brush and stumps;

e. Business and industrial uses, not agricultural, which involve the on-site disposal of process wastes from operations;

f. Disposal of liquid or leachable wastes, except for:

(1) the installation or enlargement of a subsurface waste disposal system for a residential dwelling, and;

(2) normal agricultural operations, and;

(3) Business or industrial uses which involve the on-site disposal of wastes from personal hygiene and food preparation for residents, patrons and employees.

g. Underground storage and/or transmission of oil, gasoline or other petroleum products excluding liquified petroleum gases;

h. Outdoor storage of salt, de-icing materials, pesticides or herbicides;

i. The use of septic system cleaners which contain toxic chemicals;

6. Restricted Uses

a. Excavation for removal of earth, sand, gravel and other soils shall not extend closer than five (5) feet above the annual high groundwater table. This section shall not apply to uses incidental to permitted uses, including but not limited to providing for the installation or maintenance of structural foundations, freshwater ponds, utility conduits or on-site sewage disposal.

(1) Access road(s) to extractive operation sites shall include a gate or other secure mechanism to restrict public access to the site.

b. The use of sodium chloride for ice control shall be minimized, consistent with public highway safety requirements.

c. Commercial fertilizers, pesticides, herbicides, or other leachable materials shall not be used in amounts which result in groundwater contamination.

7. Drainage

a. All runoff from impervious surfaces shall be recharged on the site by being diverted toward areas covered with vegetation for surface infiltration to the extent possible. Dry wells shall be used only where other methods are infeasible, and shall be preceded by oil, grease and sediment traps to facilitate removal of contamination.

8. Uses By Special Permit

Uses which may be permitted by the Board of Appeals in accordance with the regulations appearing in Section VII.B.2. of this bylaw.

a. Business and industrial activities permitted in the underlying district (either by matter of right or by special permit) shall file application for a special permit.

(1) Procedure: In addition to meeting the requirements of Section VII.B.1 of this bylaw, the applicant must file six (6) copies of a site plan, as outlined below.

(a) Said application and plan shall be prepared in accordance with the data requirements of the proposed development, including but not limited to:

o A site plan, which shall show, but not be limited to:

- drainage recharge features and provisions to prevent loss of recharge;
- provisions to control soil erosion and sedimentation;
- provisions to prevent soil compaction;
- provisions to prevent seepage from sewer pipes;
- provisions to prevent contamination of groundwater by petroleum products or hazardous chemicals.

o A complete list of chemicals, pesticides, fuels and other potentially hazardous materials to be used or stored on the premises in quantities greater than those associated with normal household use. Those businesses using or storing such hazardous materials shall file a definitive operating plan which shall show, but not limit to:

- provisions for protection of hazardous materials from vandalism;
- provisions for the prevention of corrosion and leakage of containers storing hazardous materials;
- provisions for the indoor storage of all hazardous materials;
- provisions for impervious floor surfaces with no interior drain;
- provisions to prevent hazardous materials spillage to the outside;
- provisions for storage of accumulated waste;
- provisions for the immediate containment and clean-up of any hazardous spills.

(b) The Zoning Board of Appeals (ZBA) shall refer copies of the application to the Board of Health, Planning Board, Conservation Commission, and the Town Engineer, which shall review the application either separately or jointly and shall submit their recommendation and comments to the ZBA. Failure of boards/departments to make recommendations within 35 days of the referral of the application shall be deemed to be lack of opposition.

(c) After notice and public hearing, and after due consideration of the reports and recommendations of the Boards/Departments, the Zoning Board of Appeals may grant such a Special Permit provided that it finds that the proposed use:

- is in harmony with the purpose and intent of this bylaw and will promote the purposes of the Aquifer Protection District;
- is appropriate to the natural topography, soils and other characteristics of the site to be developed;
- has adequate public sewerage and water facilities, or the suitable soil for on-lot sewerage and water systems;
- will not, during construction or thereafter, have an adverse environmental impact on groundwater resources in the district;
- will not adversely affect the existing or potential quality and quantity of water in the Aquifer Protection District.

9. Nonconforming Uses

Nonconforming uses which were lawfully existing, begun or in receipt of a building or special permit prior to (the first publication of notice of public hearing for this bylaw) may be continued. Such nonconforming uses may be extended or altered, as specified in Massachusetts General Laws, Ch. 40a, Sec. 6, provided that there is a finding by the Board of Appeals that such change does not increase the danger of groundwater pollution from such use.

Applicants shall follow procedures specified in Section 9 of this bylaw.

Add to Section IV. INTENSITY REGULATIONS, bottom of Table No. 1:

Aquifer Protection	40,000	150	150	150	50	15	40	2 1/2	35	20%

0035C

TOWN OF BURLINGTON

BURLINGTON, MASSACHUSETTS 01803
TOWN HALL 272-6700

TO: All Firms Handling Toxic or Hazardous Materials

FROM: Board of Health, Town of Burlington

In 1983, the Town of Burlington adopted a Bylaw entitled: Control of Toxic and Hazardous Materials. The intent of this Bylaw is to protect the Town's environment and aquifer from further contamination. The Bylaw requires that every owner and operator of a commercial or industrial establishment that handles "toxic or hazardous materials" (as defined in the Bylaw) register with the Board of Health if the total amount of such materials exceeds Fifty (50) gallons liquid or twenty-five (25) pounds dry weight. It is also required of these firms to post spill control and countermeasure plans at prominent and appropriate locations in the firm and keep an inventory of such materials. When available, a copy of this posting should be forwarded to the Board of Health. It is also incumbent upon the firm to report additional information regarding any storage tanks of toxic or hazardous materials which exist on your property in Burlington. (Refer to Items 7.0 and 8.0 of the enclosed form.) In addition, all underground tanks (UT) in service for 20 years and with a capacity of greater than 1000 gallons must be tested annually and the results forwarded to the Board of Health.

Please fill out the enclosed form and return within thirty (30) days of the postmark of this notice to: BURLINGTON BOARD OF HEALTH
ENVIRONMENTAL ENGINEER'S OFFICE
TOWN HALL
BURLINGTON, MA 01803
in order to comply with the Bylaw. To those questions which are not applicable to your situations, respond with the letters "NA". In addition, it is your responsibility to list any "toxic and hazardous materials" which your firm handles, uses, or stores, as requested in Item 2.0 of the enclosed form.

In addition to returning the Hazardous Materials Registration Form, please include, if applicable, a copy of your EPA Notification of Hazardous Waste Activity Form, or EPA Annual Hazardous Waste Report, your Contingency Plan, if mandated by 310 CMR Hazardous Waste Regulations and your WRA Industrial User Permit Application.

TOWN OF BURLINGTON

HAZARDOUS MATERIALS REGISTRATION FORM

NAME OF FIRM: _____

ADDRESS: _____

TELEPHONE: _____

FIRM'S MANAGER: _____

TYPE OF BUSINESS: LIST PRINCIPAL PRODUCTS OR SERVICES

1.0 DOES YOUR BURLINGTON FIRM HANDLE, USE, OR STORE ANY "TOXIC OR HAZARDOUS" MATERIALS, AS DEFINED IN THE "CONTROL OF TOXIC AND HAZARDOUS MATERIALS" BYLAW? YES___ NO___

IF THE ANSWER IS NO, GO TO ITEM 11.0.

IF THE ANSWER IS YES, GO TO ITEM 2.0.

2.0 LIST "TOXIC AND HAZARDOUS" MATERIALS OR WASTES THAT YOUR BURLINGTON FIRM HANDLES. EXPRESS QUANTITIES IN EITHER GALLONS OR POUNDS, AND ONLY THOSE HANDLED IN EXCESS OF FIVE (5) GALLONS OR TWO (2) POUNDS DRY WEIGHT.

MATERIAL NAME OR EPA WASTE CODE	TYPE OF STORAGE[1]	MAXIMUM QUANTITY	CONSUMPTION OR GENERATION RATE[2]	HAZARDOUS PROPERTIES (OR DOT HAZARD CLASS)

[1]USE CODE: UT=UNDERGROUND TANK, AT=ABOVEGROUND TANK, AC=ABOVEGROUND CONTAINERS OR DRUMS

[2]MONTHLY BASIS

3.0 DOES YOUR FIRM HAVE WRITTEN SPILL CONTROL AND COUNTERMEASURE PLANS TO DEAL WITH A MISHAP/ACCIDENT INVOLVING "TOXIC OR HAZARDOUS MATERIALS" USED BY YOUR COMPANY?

YES___ NO___

4.0 WHO ARE YOUR FIRM'S EMERGENCY COORDINATORS?

NAME_____ PHONE NO._____

NAME_____ PHONE NO._____

5.0 DOES YOUR FIRM HAVE AN EPA HAZARDOUS WASTE GENERATOR ID NUMBER?

EPA ID NO._____

6.0 DOES YOUR FIRM HAVE AN INDUSTRIAL USER DISCHARGE PERMIT?

WRA PERMIT NO._____

7.0 DOES YOUR FIRM HAVE ANY UNDERGROUND STORAGE TANKS (UT)? PLEASE NOTE THAT ALL TANKS IN SERVICE FOR 20 YEARS AND WITH A CAPACITY OF OVER 1000 GALLONS MUST BE TESTED ANNUALLY, UNLESS THE TANK(S) IS WITHIN SECONDARY CONTAINMENT.

	TANK 1UT	TANK 2UT	TANK 3UT	TANK 4UT
DATE OF INSTALLATION				
MOST RECENT TANK TEST				
SIZE, GALLONS				
TYPE				
STORED MATERIAL				

8.0 DOES YOUR FIRM HAVE ANY ABOVEGROUND STORAGE TANKS?

	TANK 1AT	TANK 2AT	TANK 3AT	TANK 4AT
DATE OF INSTALLATION				
SIZE, GALLONS				
TYPE				
STORED MATERIAL				

9.0 IN THE SPACE PROVIDED BELOW, DRAW A SKETCH MAP OF THE PROPERTY SHOWING THE LOCATION OF STORAGE TANKS AND OTHER HAZARDOUS MATERIALS STORED OUTDOORS. PLEASE IDENTIFY STORAGE TANKS USING THE SAME NUMBER/LETTER SYSTEM USED IN ITEMS 7.0 - 8.0.

10.0 IN THE SPACE PROVIDED BELOW, DRAW A FLOOR PLAN OF THE INTERIOR OF YOUR BUILDING SHOWING LOCATIONS WHERE HAZARDOUS MATERIALS ARE HANDLED, USED, OR STORED. ALSO, LOCATE SAFETY AND SPILL CONTROL EQUIPMENT/MATERIALS, AS WELL AS COUNTERMEASURE PLAN POSTINGS. IN CASE OF AN EMERGENCY RESPONSE, PLEASE NOTE ANY SPECIAL HAZARDS TO EMERGENCY RESPONSE PERSONNEL WITHIN THESE AREAS.

11.0 NAME OF INDIVIDUAL COMPLETING FORM:_____

TITLE:_____

TELEPHONE NO:_____

RETURN TO: BURLINGTON BOARD OF HEALTH
ENVIRONMENTAL ENGINEER'S OFFICE
TOWN HALL
BURLINGTON, MA 01803

TOWN OF BURLINGTON
BURLINGTON MASSACHUSETTS 01803
TOWN HALL 272-6700

TOWN CLERK
CATHERINE R. McKIM

ADJOURNED (FIRST) TOWN MEETING

January 12, 1983

ARTICLE 17 - Re: Water Resource and Aquifer Zoning Districts

UNANIMOUSLY VOTED that the Town amend the Burlington Zoning By-Law as follows

I. Amend Article VIII, SPECIAL DISTRICTS, by inserting a new section 8.3.0 to read as follows:

8.3.0 Aquifer and Water Resource Districts

8.3.1 Purpose

The purposes of these Aquifer and Water Resource Districts are:

a. to promote the health, safety, and general welfare of the community;

b. to protect, preserve and maintain the existing and potential groundwater supply and groundwater recharge areas within the known aquifers of the town;

c. to preserve and protect present and potential sources of water supply for the public health and safety;

d. to conserve the natural resources of the town;

e. to protect the groundwater and groundwater recharge areas of the town from adverse development or land use practices, and;

f. to prevent blight and the pollution of the environment.

8.3.2 Definition of Aquifer and Water Resource Districts

The Aquifer and Water Resource Districts are superimposed over other districts established by this By-Law. They include all lands shown with the boundaries designated as Aquifer District and Water Resource District on the overlay to the Zoning Map

entitled Aquifer and Water Resource Districts 1983. These maps, as may be amended from time to time, are hereby made a part of this By-Law.

"The Aquifer District encompasses all properties or portions of properties whose ground and surface waters directly recharge the wellfield. The wellfield is directly recharged by waters which enter the cone of depression, by waters in the area upgradient to the cone of depression and by induced infiltration from a stream or surface water body within the cone of influence.

The Water Resource District encompasses all properties or portions of properties whose ground and surface waters drain into Vine Brook and its tributaries."

8.3.3 Interpretation and Application

Within Aquifer and Water Resource Districts the requirements of the underlying districts continue to apply, except that uses are prohibited where indicated by No in Sections 4.2 through 4.4, and require a special permit where indicated by SP, even where underlying district requirements are more permissive. Where there is a Yes entry, the underlying district requirements are controlling.

8.3.4 Special Permit Procedure

8.3.4.1 Special Permit Granting Authority. The Special Permit Granting Authority (SPGA) shall be the Planning Board. Such special permit shall be granted if the SPGA determines that the intent of this By-Law as well as the specific criteria of Section 8.3.4.2 are met. In making such determination, the SPGA shall give consideration to the simplicity, reliability, and feasibility of the control measures proposed and the degree of threat to water quality which would result if the control measures were to fail.

8.3.4.2 Special Permit Criteria. Special permits shall be granted only if the SPGA determines that at the boundaries of the premises the groundwater quality resulting from on-site waste disposal, other on-site operations, natural recharge, and background water quality will not fall below the standards established by DEQE in "Drinking Water Standards of Massachusetts' or, for parameters where no standard exists, below standards established by the Board of Health

and, where existing groundwater quality is already below those standards, upon determination that the proposed activity will result in no further degradation.

8.3.4.3 Submittals. The following shall be submitted in addition to the requirements of Section 9.2.0 in applying for a special permit within the Aquifer or Water Resource Districts.

a) A complete list of all chemicals, pesticides, fuels, and other potentially toxic or hazardous materials to be used or stored on the premises in quanitities greater than those associated with normal household use, accompanied by a description of measures proposed to protect from vandalism, corrosion, and leakage, and to provide for spill prevention and countermeasures.

b) A description of potentially toxic or hazardous wastes to be generated, indicating storage and disposal method.

c) Evidence of joint permit approval under the Metropolitan District Commission (MDC) Rules and Regulations Covering Discharge of Sewage, Drainage Substances, or Wastes to Sewerage Works Within the Metropolitan Sewerage District and the Town of Burlington's Regulation of Sewer Use for any discharge of industrial wastes to the sewer system.

d) For underground storage of toxic and hazardous materials, evidence of qualified professional supervision of system design and installation.

e) Analysis by a qualified professional Engineer experienced in groundwater evaluation and/or geohydrology certifying compliance with Section 8.3.4.2.

8.3.5 Design and Operations Requirements

Within Aquifer and Water Resource Districts, the following design and operations requirements shall be observed, except for single family dwellings.

8.3.5.1 Safeguards. Provision shall be made to protect against toxic or hazardous materials discharge or loss through corrosion, accidental damage, spillage, or vandalism through such measures as provision for spill control in the vicinity of chemical or fuel delivery points, secure storage areas for toxic or hazardous materials, and indoor storage provisions for corrodable or dissolvable materials.

8.3.5.2 Location. Where the premises are partially outside of the Aquifer or Water Resource Districts, such potential pollution sources as on-site waste disposal systems shall, to the degree feasible, be located outside the District.

8.3.5.3 Disposal. Provisions shall be made to assure that any waste disposed into the sewers shall conform with the Metropolitan District Commission's Rules and Regulations Covering Discharge of Sewage, Drainage Substances, or Wastes to Sewerage Works Within the Metropolitan Sewerage District and the Town of Burlington's Sewer Use Regulations. Connecting sewers from the building shall be vitreous clay pipe or any other pipe shown to provide equivalent protection against corrosion.

8.3.5.4 Excavation and Grading. All excavation and grading in the Aquifer District shall maintain a depth of at least 4 feet of clean fill above the high water table.

8.3.5.5 Impervious Surfaces. Within the Aquifer District no more than 20 percent of the lot shall be covered with impervious surfaces.

8.3.5.6 Monitoring. Periodic monitoring may be required by the SPGA, including sampling of wastewater disposed to off-site systems or drywells and sampling from groundwater monitoring wells to be located and constructed as specified in the Special Permit with reports to be submitted to the Special Permit Granting Authority and the Board of Health, and costs to be borne by the owner of the premises.

II. Amend Article IV, Section 4.1.0 Applicability of Regulations by deleting "Sections 4.2.0 and 4.3.0" and inserting in its place "Sections 4.2.0 through 4.4.0".

III. Amend Article IV by inserting two new districts at the end of each chart section with use applicability shown as follows: (see attached revised chart Section 4.2.0 to 4.4.0).

IV. Amend Article II, DEFINITIONS, Subsection 2.19 Districts by adding the following at the end thereof:

"In addition, there are Wetlands, Flood Plain, Aquifer, and Water Resource overlay districts."

Further amend Article II, DEFINITIONS, by adding the following definition at its appropriate alphabetical location:

"Toxic or Hazardous Materials' means any substance or mixture of such physical, chemical or infectious characteristics as to pose a significant actual or potential hazard to water supplies, or other hazard to human health, if such substance or mixture were discharged in this town. Toxic and Hazardous Materials also means pesticides, herbicides and fungicides as well as all liquid hydrocarbon products including, but not limited to, gasoline, fuel and diesel oil; and also any other toxic, caustic or corrosive chemicals, radioactive materials, or other substance controlled as being toxic or hazardous by the Division of Hazardous Waste under the provisions of Ch. 21 (c), G.L."

V. Amend the Burlington Zoning Maps by adopting the revised set of maps dated 1983, adding delineation of the Aquifer and Water Resource Districts.

VI. Amend Article III, Section 3.1.1 by adding the following at the end thereof:

"W Wetlands
A Aquifer District
WR Water Resources District"

VII. Amend Article III, Section 3.2.0 Location of Districts by adding at the end thereof:

"The Wetlands overlay district is designated on the Topographic Sheets, Town of Burlington entitled Wetlands 1977. The Aquifer and Water Resources overlay districts are designated on the overlay to the zoning map entitled Aquifer and Water Resources Districts 1983."

USE DESIGNATION		DISTRICT									OVERLAY DISTRICTS	
4.2.1	Residence Uses	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.2.1.1	One family dwellings	Yes	No	No	No	No	No	No	No	No	Yes	Yes
4.2.1.2	Garden Apartment dwelling Units	No	Yes	No	No	No	No	No	No	No	Yes	Yes
4.2.1.3	Motels, hotels, motor hotel	No	No	No	No	No	No	No	SP	No	Yes	Yes
4.2.1.4	Garden Apartment dwelling units purchased, or erected and maintained by the Burlington Housing Authority for the purpose of providing subsidized housing	No	Yes	No	No	No	No	No	No	No	Yes	Yes
4.2.1.5	Dormitories primarily used for non-profit educational corporations, for religious purposes, or for public purposes.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.1.6	One-family dwellings purchased or erected and maintained by the Burlington Housing Authority for the purpose of providing subsidized housing	Yes	No	No	No	No	No	No	No	No	Yes	Yes
4.2.1.7	Garden Apartment dwelling units purchased, or erected and maintained for the purpose of providing subsidized housing	No	SP	No	No	No	No	No	No	No	Yes	Yes
4.2.1.8	Tents, trailers, campers, and mobile homes	No	No	No	No	No	No	No	No	No	Yes	Yes
4.2.1.9	Dormitories other than those specified in 2.1.5	No	SP	No	No	No	No	No	No	No	Yes	Yes

USE DESIGNATION		DISTRICT									OVERLAY DISTRICTS	
4.2.2	Institutional and Recreational Uses	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.2.2.1	Places primarily used for religious purposes, including rectories, and parish houses	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.2.2	Places primarily used for non-profit Educational Corporations, including related museums, libraries, and recreational facilities	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.2.3	Day nursery, nursery school, private kindergarten or other agency giving day care to children, other than those used for non-profit Educational Corporations, for religious purposes, or those owned by the Commonwealth or any of its subdivisions.	No	No	SP	SP	SP	SP	SP	SP	SP	Yes	Yes
4.2.2.4	Cemeteries and related facilities	SP	SP	SP	SP	SP	SP	SP	SP	SP	Yes	Yes
4.2.2.5	Fire stations and sub-fire stations	SP	SP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.2.6	Police stations	SP	SP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.2.7	Municipal maintenance and garage facilities	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No	SP
4.2.2.8	Public parks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.2.9	Related facilities for public parks	SP	SP	SP	SP	SP	SP	SP	SP	SP	Yes	Yes
4.2.2.10	Public libraries, public museums, public art galleries	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.2.11	Community centers and public recreation buildings	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.2.12	Non-profit private clubs, recreational centers and facilities	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.2.13	Private museums, private art galleries	No	No	SP	SP	SP	SP	SP	SP	SP	Yes	Yes

USE DESIGNATION		DISTRICT									OVERLAY DISTRICTS	
4.2.2	Institutional and Recreational Uses (continued)	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.2.2.14	Other than non-profit educational uses on land not owned or leased by the Commonwealth or any of its agencies, subdivisions or bodies politic, by a religious sect or denomination, or by a non-profit educational corporation.	No	No	SP	Yes	Yes	SP	SP	SP	SP	Yes	Yes
4.2.2.15	Golf courses and related facilities	No	No	No	No	No	SP	No	No	No	Yes	Yes
4.2.2.16	Billiard rooms, bowling alleys, dance halls, tennis clubs, skating rinks, health clubs and similar commercial amusement places, including membership clubs, public	No	No	No	No	No	SP	No	No	No	Yes	Yes
4.2.2.17	Miniature, driving, and novelty golf installations	No	No	No	No	No	SP	No	No	No	Yes	Yes
4.2.2.18	Places and buildings for public assembly other than above	No	No	No	No	No	SP	No	No	No	Yes	Yes
4.2.2.19	Hospitals, sanitoria	No	No	No	No	SP	No	SP	SP	SP	No	SP
4.2.2.20	Convalescent, rest homes and nursing homes	No	No	No	No	SP	No	SP	SP	SP	Yes	Yes
4.2.2.21	Clinics	No	No	No	No	SP	No	SP	SP	SP	No	SP
4.2.2.22	Telephone Exchanges	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.2.23	Passenger stations; landing fields; sites, buildings, and facilities for other public services; public works structures	No	No	No	No	SP	SP	SP	SP	SP	SP	SP
4.2.2.24	Radio and Television Transmitting Sites	No	No	No	No	SP	SP	SP	SP	SP	Yes	Yes
4.2.2.25	Theaters and Cinemas	No	No	No	No	SP	SP	SP	SP	SP	Yes	Yes

(ART IV) Section 4.2.0 Principal Use Regulations Schedule

USE DESIGNATION		DISTRICT									OVERLAY DISTRICTS	
4.2.3	Agricultural and Animal Husbandry Uses	R O	R C	B N	B L	B G	B T	I G	I H	I R	A	WR
4.2.3.1	All kinds of agriculture, horticulture and floriculture on parcels of five acres or more	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.3.2	All kinds of agriculture, horticulture and floriculture on parcels of less than five acres	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.3.3	Garden centers; also commercial greenhouses and nurseries occupying five (5) acres of land or less	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.3.4	Commercial raising, boarding, breeding, or keeping of birds, fish, and animals; subject to the regulations of the Board of Health	No	No	No	No	SP	SP	SP	SP	SP	SP	SP
4.2.3.5	Manure storage	No	No	No	No	SP	SP	SP	SP	SP	No	No
4.2.3.6	Pesticide Herbicide Fungicide Application, Outdoor Storage,	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP
4.2.4	Office Uses	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.2.4.1	Professional offices such as, but not limited to, physicians, dentists, opticians, real estate brokers, lawyers	No	No	SP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.4.2	Offices of salesmen, agents, and representatives of manufacturing, distributing, insurance, and wholesale companies	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.4.3	Administrative, executive, and similar offices	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.2.4.4	Public offices	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

USE DESIGNATION		DISTRICT									OVERLAY DISTRICTS	
4.2.5	Automotive Sales and Service Uses	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.2.5.1	Retail gasoline, oil and lubrication stations with the incidental sale and installation of tires and other automobile accessories, maintenance and minor repairs of motor vehicles	No	No	No	No	No	SP	No	No	No	No	SP
4.2.5.2	Automotive repair shops	No	No	No	No	No	SP	No	No	No	No	SP
4.2.5.3	Places for the sale and installation of tires and other automotive parts and accessories, maintenance and minor repairs of motor vehicles	No	No	No	No	No	SP	No	No	No	No	SP
4.2.5.4	Car wash establishments	No	No	No	No	No	SP	No	No	No	No	SP
4.2.5.5	Retail sales and rental of other craft, farm and other heavy machinery and vehicles, including the accessories thereof	No	No	No	No	No	SP	No	No	No	Yes	Yes
4.2.5.6	Automobile dealership	No	No	No	No	No	SP	No	No	No	Yes	Yes
4.2.5.7	Used car sales establishment	No	No	No	No	No	SP	No	No	No	Yes	Yes
4.2.5.8	Automotive rental agency	No	No	No	No	No	SP	No	No	No	Yes	Yes
4.2.6	Retail, Consumer Service and Trade Uses	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.2.6.1	Personal service businesses such as, but not limited to, barbers and hairdressers	No	No	SP	Yes	Yes	Yes	No	No	Yes	SP	SP
4.2.6.2	Convenience food stores, drugstores, retail stores for sale of beauty and health aids, smoking supplies, periodicals; none with the sale of food intended for consumption on the premises	No	No	SP	SP	Yes	SP	No	No	Yes	Yes	Yes

USE DESIGNATION		DISTRICT									OVERLAY DISTRICTS	
4.2.6	Retail, Consumer Service and Trade Uses (continued)	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.2.6.3	Retail stores other than above; showrooms	No	No	No	No	Yes	No	No	No	Yes	Yes	Yes
4.2.6.4	Post offices, banks	No	No	No	No	Yes	No	SP	Yes	Yes	Yes	Yes
4.2.6.5	Establishments for the repair of radios, televisions, appliances, and other household goods	No	No	No	No	Yes	No	No	No	No	No	SP
4.2.6.6	Photographers, decorators, stationers, dressmaking or tailoring establishments (excepting photo processing)	No	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes
4.2.6.7	Travel agencies	No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes
4.2.6.8	Laundry and dry cleaning establishments other than pick-up stations or self-service	No	No	No	No	Yes	No	No	No	No	No	SP
4.2.6.9	Fast-order food establishments	No	No	No	No	No	SP	No	No	No	Yes	Yes
4.2.6.10	Restaurants	No	No	No	No	SP	No	No	No	SP	Yes	Yes
4.2.6.11	Bakeries, printers; and similar shops or trades provided that all work shall be of custom or job order type for sale on the premises and that there shall be no production for stock or for wholesale	No	No	No	No	Yes	No	No	No	Yes	Yes	Yes
4.2.6.12	Commercial boarding, care, and treatment of birds, fish, and animals	No	No	No	No	SP	No	No	No	No	SP	SP
4.2.6.13	Sale of air conditioning, heating, refrigerating and plumbing equipment and supplies	No	No	No	No	SP	No	No	No	SP	Yes	Yes
4.2.6.14	Establishments for contractors in such services as, but not limited to, building, building maintenance, plumbing, landscaping, electrical, masonry, carpentry, well-drilling	No	No	No	No	SP	No	SP	No	No	Yes	Yes
4.2.6.15	Retail dealers in grain and animal feed	No	No	No	No	SP	No	No	No	No	Yes	Yes

USE DESIGNATION		DISTRICT									OVERLAY DISTRICTS	
4.2.6	Retail, Consumer Service and Trade Uses (continued)	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.2.6.16	Funeral parlors however denominated	No	No	No	No	SP	No	No	No	No	No	SP
4.2.6.17	Diagnostic medical laboratories appurtenant to offices of physicians and dentists	No	No	No	SP	Yes	SP	Yes	SP	SP	No	SP
4.2.6.18	Sale of structural and building supplies	No	No	No	No	No	No	SP	No	No	Yes	Yes
4.2.6.19	Kiosk	No	No	No	No	No	SP	No	No	No	Yes	Yes
4.2.6.20	Massage Parlors	No	No	No	No	No	No	No	No	No	Yes	Yes
4.2.6.21	Photo Processing	No	No	SP	SP	SP	SP	SP	SP	SP	No	No
4.2.6.22	Shoe Repair, Drycleaning and laundry pick-up stations	No	No	SP	Yes	Yes	Yes	No	No	Yes	Yes	Yes
4.2.6.23	Self-Service Laundry and Drycleaning	No	No	SP	Yes	Yes	Yes	No	No	Yes	No	SP
4.2.7	Industrial Uses	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.2.7.1	Light manufacturing or processing plants	No	No	No	No	No	No	Yes	Yes	Yes	SP	SP
4.2.7.2	Printing establishments other than those under 4.2.6.11	No	No	No	No	No	No	Yes	Yes	Yes	No	SP
4.2.7.3	Food processors, bakeries, not operated at retail	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
4.2.7.4	Laboratories engaged in research, experimental and testing activities including, but not limited to, the fields of biology, chemistry, electronics, engineering, geology, medicine and physics	No	No	No	No	No	No	SP	SP	SP	No	SP
4.2.7.5	Wholesale trade, warehousing (except toxic and hazardous materials and salts)	No	No	No	No	No	No	SP	SP	SP	Yes	Yes
4.2.7.6	Electronics Industries	No	No	No	No	No	No	SP	SP	SP	SP	SP

USE DESIGNATION		DISTRICT									OVERLAY DISTRICTS	
4.2.7	Industrial Uses (continued)	R O	R G	B N	B L	B C	B T	I G	I H	I R	A	WR
4.2.7.7	Electroplating, Metal Finishing	No	No	No	No	No	No	No	No	No	No	No
4.2.7.8	Hazardous and toxic materials/chemicals manufacture	No	No	No	No	No	No	No	No	No	No	No
4.2.7.9	Hazardous and toxic materials/chemicals use, storage, transport, disposal or discharge	No	No	No	No	No	No	SP	SP	SP	SP	SP
4.2.7.10	Commercial facilities for hazardous waste storage and treatment	No	No	No	No	No	No	No	No	No	No	No
4.3.1	Uses Normally Accessory to Residential Principal Uses	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.3.1.1	Renting of rooms without cooking facilities to not more than two persons in an existing dwelling by a family resident therein; provided there is no sign or display to advertise such use	SP	No	No	No	No	No	No	No	No	Yes	Yes
4.3.1.2	Use of a portion of a dwelling as an office by a physician, dentist or other professional person residing in the dwelling, incidental to such residence; provided there is no display or advertising other than a permitted sign	SP	No	No	No	No	No	No	No	No	Yes	Yes
4.3.1.3	Home occupations provided there is no display or advertising other than a permitted sign	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes
4.3.1.4	Garage space for parking not more than three automobiles. This subsection does not apply to farms	Yes	No	No	No	No	No	No	No	No	Yes	Yes
4.3.1.5	Outdoor parking of not more than one unregistered motor vehicle or one boat per dwelling unit	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes
4.3.1.6	Swimming pool	Yes	SP	SP	SP	SP	SP	SP	SP	SP	Yes	Yes

(ART IV) Section 4.3.0 Accessory Use Regulations Schedule

	USE DESIGNATION	DISTRICT									OVERLAY DISTRICTS	
4.3.1	Uses Normally Accessory to Residential Principal Uses (continued)	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.3.1.7	Greenhouses with a ground area of 250 square feet or less, not intended and not used for commercial purposes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.3.1.8	Tennis Courts	Yes	SP	SP	SP	SP	SP	SP	SP	SP	Yes	Yes
4.3.1.9	Bomb Shelters	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.3.1.10	Roadside stands for sale of produce grown on the premises	SP	SP	No	No	No	No	No	No	No	Yes	Yes
4.3.1.11	Sheds, barns, and similar structures	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes
4.3.1.12	The keeping of animals, other than the usual household pets; subject to restrictions of the Board of Health	SP	No	No	No	No	No	No	No	No	Yes	Yes
4.3.1.13	Buildings and structures normally accessory to garden apartments	No	Yes	No	No	No	No	No	No	No	Yes	Yes
4.3.1.14	Towers, antenna, windmills, and similar structures	SP	SP	SP	SP	SP	SP	SP	SP	SP	Yes	Yes
4.3.1.15	A mobile home to be used for a pre-determined period of time, which time may be extended by the Inspector of Bldgs. for the occupancy of a family whose dwelling has been damaged by fire or other cause until their permanent dwelling has been repaired or rebuilt. The limit of time, including extensions, shall not exceed a period of one (1) year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.3.2	Uses Normally Accessory to Non-residential Principal Uses	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.3.2.1	Incidental sale at retail of parts or components necessary for the maintenance of articles stored and distributed	No	No	No	No	No	No	SP	No	No	Yes	Yes
4.3.2.2	Retail uses such as cafeterias, soda or dairy bars, wholly within the same building as the principal permitted use, conducted primarily for convenience of employees and with no exterior advertising display	No	No	No	SP	Yes	Yes	Yes	Yes	Yes	Yes	Yes

USE DESIGNATION		DISTRICT									OVERLAY DISTRICTS	
4.3.2	Uses Normally Accessory to Non-residential Principal Uses	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.3.2.3	Retail uses in support of a hotel or motor hotel, such as dining halls, restaurants, cafeterias, soda or dairy bars and shops wholly within the hotel or motor hotel building	No	No	No	No	No	No	SP	SP	No	Yes	Yes
4.3.2.4	Delicatessens, lunch counters and soda fountains incidental to the permitted business of a drugstore, food store	No	No	No	SP	Yes	SP	No	No	Yes	Yes	Yes
4.3.2.5	Keeping of more than one protective animals	SP	SP	SP	SP	SP	SP	SP	SP	SP	Yes	Yes
4.3.2.6	Outdoor storage of supplies and equipment incidental to permitted uses, subject to requirements for location, lighting, screening, fencing, cover and safety precautions	Yes	No	No	No	SP	SP	SP	SP	SP	Yes	Yes
4.3.2.7	Off-street outdoor overnight parking of freight-carrying or material-handling vehicles and equipment or buses	No	No	No	No	Yes	SP	Yes	Yes	Yes	Yes	Yes
4.3.2.8	Maintenance shops, power plants, machine shops and similar structures to support permitted uses	No	No	No	No	SP	SP	Yes	Yes	Yes	SP	SP
4.3.2.9	Garage space for parking more than three (3) vehicles	No	No	No	No	No	No	No	SP	No	Yes	Yes
4.3.2.10	Off-street outdoor parking of vehicles, other than those in 3.2.7	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.3.2.11	Portion of the premises as permanent residence of proprietor or manager of an establishment	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.3.2.12	Warehousing incidental to a permitted principal use (except hazardous and toxic materials/chemicals)	No	No	No	No	No	No	SP	SP	SP	Yes	Yes
4.3.2.13	Kiosks	No	No	No	No	No	SP	No	No	No	Yes	Yes
4.3.2.14	Incidental sale at retail of the same merchandise sold at wholesale	No	No	No	No	No	No	SP	No	No	Yes	Yes

USE DESIGNATION		DISTRICT									OVERLAY DISTRICTS	
4.3.2	Uses Normally Accessory to Non-residential Principal Uses (continued)	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.3.2.15	Storage and disposal of oils and fuels/petroleum products	No	No	SP	SP	SP	SP	SP	SP	SP	No	SP
4.3.2.16	Parking area for more than 200 spaces	No	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP
4.3.2.17	Off-street outdoor overnight parking of freight - carrying or material - handling vehicles and equipment containing toxic and hazardous materials/chemicals	No	No	No	No	No	No	SP	SP	SP	SP	SP
4.4.1	Principal Uses in the Wetlands District	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.4.1.1	Conservation of soil, water plants, and wildlife including wildlife management shelters	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.4.1.2	Outdoor noncommercial recreation limited to nature study areas, walkways, boating or fishing where otherwise legally permitted	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.4.1.3	Agriculture, horticulture and floriculture	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	See	4.2.3
4.4.1.4	Maintenance or repair of existing structures, roadways and utilities	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.4.1.5	Periodic maintenance of existing water courses and maintenance for essential services	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.4.1.6	Creation of a pond or pool or other changes in water courses for swimming, fishing or other recreational uses, agricultural uses, scenic features, drainage improvements	SP	SP	SP	SP	SP	SP	SP	SP	SP	No	SP
4.4.1.7	Structures for essential services	SP	SP	SP	SP	SP	SP	SP	SP	SP	Yes	Yes
4.4.1.8	Dredging expressly for mosquito or flood control by an authorized public agency	SP	SP	SP	SP	SP	SP	SP	SP	SP	Yes	Yes

USE DESIGNATION		DISTRICT									OVERLAY DISTRICTS	
4.4.1	Principal Uses in the Wetlands District	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.4.1.9	Temporary, not to exceed three months, storage of materials (excluding fill materials and hazardous and toxic materials) or equipment	SP	SP	SP	SP	SP	SP	SP	SP	SP	Yes	Yes
4.4.1.10	Outdoor noncommercial recreation not specifically permitted by right in section 4.4.1.2 including public parks, nonpaved playfields, and similar activities	SP	SP	SP	SP	SP	SP	SP	SP	SP	Yes	Yes
4.4.1.11	Discharges from manmade structures into the wetlands	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP
4.4.1.12	Structures for radio or television transmission by participants in emergency broadcast system	SP	SP	SP	SP	SP	SP	SP	SP	SP	Yes	Yes
4.4.2	Accessory Uses in the Wetlands District	R O	R G	B N	B L	B G	B T	I G	I H	I R	A	WR
4.4.2.1	Accessory uses limited to fences, flagpoles, noncommercial signs, docks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

X.B. WATER RESOURCE DISTRICT REGULATIONS

X.B.1. PURPOSE

The purpose of the Water Resource District is to protect the public health by preventing contamination of the surface water and ground water resources providing existing and potential water supply for the Town of Salisbury.

X.B.2. ESTABLISHMENT OF DISTRICT

The Water Resource District is herein established as an overlay district and includes the aquifers and aquifer recharge areas which provide water supply for the Town of Salisbury, as shown on a map entitled "Water Resource District, Town of Salisbury, Massachusetts," dated May, 1987 and on file with the Town Clerk, Planning Board, and Zoning Board of Appeals.

Where the bounds of the Water Resource District, as delineated on the Water Resource District Map, are in doubt or dispute, the burden of proof shall be upon the owners of the land in question to show where the bounds should properly be located. The town may engage a professional hydrogeologist to determine more accurately the location and extent of the aquifers and recharge areas, and shall charge the owner for all or part of the cost of the investigation.

Land in a Water Resource District may be used for any purpose otherwise permitted in the underlying district, subject to the following additional restrictions.

X.B.3. USE REGULATIONS

1. **Permitted Uses**

Within the Water Resource District, the following uses are permitted, provided that all necessary permits, orders, and approvals required by local, state, and federal law shall have been obtained:

- Conservation of soil, water, plants, and wildlife;

- Outdoor active and passive recreation;

- Operation and maintenance of roads, utilities, and other structures, provided there is no significant increase in impervious pavement;

- Operation and maintenance of water bodies and water control, supply, and conservation devices;

- Residential and commercial development permitted in the underlying district provided that not more than 20 percent of a building lot is rendered impervious;

- Farming, gardening, nursery, conservation, forestry, harvesting, and grazing uses, provided that fertilizers, herbicides, pesticides, manure, and other leachable materials incidental to such uses are not stored uncovered out-of-doors.

2. **Prohibited Uses**

Within the Water Resource District the following uses are prohibited:

- Sanitary landfill, septage lagoon, municipal or industrial wastewater treatment facility;

- Road salt stockpile or disposal of snow from outside the Water Resource District

- Junkyard, salvage yard, or truck terminal with more than ten trucks;

- Gasoline station; truck, boat, or automobile repair or body shop;

- Commercial laundry or dry cleaning;

- Commercial car wash;

- Metal plating, finishing, or polishing;

- Electronic circuit assembly;

- Furniture stripping or refinishing;

- Photographic processing;

- Printing;

- Chemical or bacteriological laboratory;

- Any other use which involves as a principal activity the manufacture, storage, use, transport, or disposal of toxic or hazardous materials;

3. **Special Permit Uses**

Within the Water Resource District the following uses are permitted only upon the issuance of a Special Permit by the Zoning Board of Appeals:

- Any nonagricultural use involving the retention of less than thirty (30) percent of a lot area in its natural state, with no more than minor removal of existing trees and ground vegetation or rendering impervious more than twenty (20) percent of lot area.

- Any use, other than a single-family dwelling, having on-site disposal of domestic wastes greater than 1,500 gallons per day (gpd) as estimated by a professional engineer or registered sanitarian.

- Residential dwellings served by on-site sewage disposal systems with less than one-acre lot size.

- Storage of fuel or other hazardous material in quantities greater than normally associated with an allowed residential, commercial or agricultural use, provided that such storage is not the principal activity of the use.

- Storage of manure uncovered out-of-doors.

- Mining operations, including sand and gravel removal, except as incidental to an allowed use.

- Application of fertilizers, herbicides, or pesticides for non-domestic or non-agricultural uses, provided that such application will not cause any significant adverse impacts on the soil, surface water, or groundwater.

X.B.4. SPECIAL PERMIT GRANTING AUTHORITY

The Special Permit Granting Authority shall be the Zoning Board of Appeals, or ZBA. A Special Permit shall be granted if the ZBA determines that the intent of this regulation as well as the specific criteria of X.B.3 above and X.B.5, following, are met. In making such determination, the ZBA shall give consideration to the simplicity, reliability, and feasibility of the control measures proposed and the degree of threat to ground water quality which would result if the control measures failed.

Upon receipt of a Special Permit application, the ZBA shall transmit one copy each to the Planning Board, Board of Selectmen, Board of Health, Salisbury Water Supply Company, Conservation Commission, Building Inspector, Fire Chief, and Local Hazardous Waste Coordinator for their written recommendations. Failure to respond within thirty (30) days of referral of the application shall indicate lack of opposition by said agencies. The copies necessary to fulfill this requirement shall be furnished by the applicant.

In making its decision, the ZBA shall explain any departures from the recommendations of the other town agencies specified above.

X.B.5. SPECIAL PERMIT CRITERIA

Special Permits under X.B.4 above shall be granted only if the ZBA determines, after consultation with the other agencies specified above, that ground water quality resulting from on-site wastewater disposal or other operations on-site shall not fall below federal or state standards for drinking water, or if existing ground water quality is already below those standards, on-site disposal or operations shall not result in further water quality deterioration.

In applying for a Special Permit, the applicant shall submit the following information:

1. A complete list of all chemicals, pesticides, herbicides, fuels, and other potentially toxic or hazardous materials to be used or stored on the premises in quantities greater than those normally associated with an allowed residential, commercial or agricultural use, accompanied by a description of measures proposed to protect all storage containers/facilities from vandalism, corrosion, and leakage and to provide for control of spills.

2. For runoff from impervious surfaces greater than 20 percent of total lot area, evidence that such runoff will be recharged on-site and diverted towards areas covered with vegetation for surface infiltration to the maximum extent possible. Dry wells shall be used only where other methods are infeasible and shall be preceded by oil, grease, and sediment traps to facilitate removal of contaminants.

3. For disposal on-site of domestic wastewater, other than from a single-family dwelling, with an estimated sewage flow of greater than 1,500 gpd, evidence of qualified professional supervision of the design and installation of the disposal system, including a narrative assessment of nitrate, sodium, coliform bacteria, and hazardous material impact, if any, on groundwater quality.

4. For residential dwellings with on-site sewage disposal systems with less than one-acre lot size, evidence as specified in (3) above.

5. For outdoor uncovered manure storage and for mining operations, including sand and gravel removal except as incidental to an allowed use, evidence from a professional engineer or hydrogeologist that such operations will not adversely affect the quantity or quality of surface water or ground water in the Water Resource District. No gravel or mineral extraction shall occur within four feet of the seasonal high groundwater table.

X.B.6. NONCONFORMING USES

Any use of a building, structure, or land existing at the effective date of this bylaw or amendments thereto and not in conformance with the provisions of this bylaw shall be considered a nonconforming use. Such use shall be governed as per the provisions of Section VII of the Zoning Bylaw.

Article __: Establishment of Water Resource District Bylaw

Purpose: This would be a new bylaw which would protect the public health by restricting hazardous materials disposal and certain other uses of land that could contaminate the groundwater resources providing water supply to residents of Salisbury. Land uses not constituting a threat to the water supply would not be affected by this bylaw.

Recommendation: The Planning Board strongly recommends that this bylaw be adopted in order to protect public health and insure a safe water supply for our citizens. One Salisbury Water Supply Company well has already been closed due to chemical contamination, and preventive action should be taken to protect the remaining wells and the groundwater resource that provides much of the town's water supply needs. This bylaw would be an overlay district that would not materially change the uses allowed in the underlying district; however, hazardous materials disposal and certain other activities that could constitute a threat to the water supply would be regulated or restricted in the Water Resource District, the boundaries of which have been determined by a detailed hydrogeologic investigation.

MODEL SUBDIVISION RULES AND REGULATIONS FOR GROUNDWATER PROTECTION

(Prepared by the Metropolitan Area Planning Council, 1982)

MODEL SUBDIVISION RULES AND REGULATIONS FOR GROUNDWATER PROTECTION

1. Definitive Subdivision Plan Submission Requirements:

   -- proposed system of drainage, including the location of all wetlands, water bodies, streams, open drains and ditches (natural or man-made) and flowage rights, public and private, adjacent to or within the proposed subdivision, in a general manner.

   -- zoning classification of all land shown in the plan including overlay zoning such as flood-plain, watershed,or aquifer districts.

   -- the board may require soil surveys and/or test pits or borings to be prepared at the applicant's expense to determine the suitability of the land for the proposed ways, drainage,and utilities.

   -- existing and proposed drainage including drainage areas inside the subdivision, areas outside the subdivision which drain into it, and the route, for all existing and proposed drainage discharging from the subdivision, to the primary receiving water course or other body of water. Calculations shall be figured on the modified soil-cover complex method, unless the board agrees to some other method, using at least 50-year frequency storm data.

   -- size and location of existing and proposed water-supply mains and their appurtenances, hydrants, sewer pipes, and their appurtenances and/or sewage disposal systems, storm drains and their appurtenances, and easements pertinent thereto, and curbs and curb dimensions, including data on borings and soil test pits, and methods of carrying water to the nearest watercourse or easements for drainage as needed, whether or not within the subdivision.

   -- if surface water drains will discharge onto adjacent existing streets or onto adjacent properties not owned by the applicant, the applicant shall clearly indicate what course the discharge will take, and shall present to the Board evidence from the Town Engineer or the owner of adjacent property that such discharge is satisfactory and permitted by public or private ownership of adjacent street or property.

   -- maximum groundwater table elevation and direction of groundwater flow.

   -- location of base-flood elevation (100-year frequency storm) if encountered within 100 feet of subdivision.

2. Environmental Analysis

   -- any subdivision creating frontage potentially allowing (fifteen) or more lots shall be based on an Environmental Analysis and, in addition, the Board may require for subdivisions of fewer than 30 lots that certain of the following be submitted where such information

is necessary to evaluate the plan because of special circumstances of the location or proposal including, but not limited to, proximity to aquifers, surface water supplies, or municipal wells. Environmental analyses shall be prepared by an interdisciplinary team to include a Land Surveyor, Civil Engineer, and Architect or Landscape Architect, unless otherwise agreed to by the planning board. The following documentation is required from an environmental analysis:

a. The plans shall show the following:

-- the same data as on the definitive plan, reproduced as a clear acetate, or mylar overlay.

-- topography at two-foot contour intervals, with graphic drainage analysis, and indication of the 100-year flood elevation.

-- vegetative cover analysis, including identification of general cover type (wooded, cropland, brush, wetland, etc.), location of all major tree groupings, plus other outstanding trees or other botanical features, important wildlife habitats, and identification of areas not to be disturbed by construction.

-- soil types, based on the most recent US soils study, maximum groundwater level, location and results of soil percolation, or other subsurface tests.

-- for subdivisions located within identified aquifer or recharge areas the environmental analysis shall include an analysis of open and closed drainage system alternatives, examining effects upon the basin water budget and upon the speed of transport of contaminants.

-- location of surface water bodies, wetlands, aquifer or recharge areas for existing or potential drinking water supplies.

b. A narrative statement also shall be submitted, documenting the following, with references to the above maps as germane:

-- impact upon surface water quality and level.

-- impact upon groundwater quality and level.

-- capability of soils, vegetative cover and proposed erosion control measures to support proposed development without erosion, silting or other instability.

-- relationship to G.L. ch. 131, s. 40.

c. The report also shall estimate the effect of the project on the town water supply, and proposed water-conservation measures.

d. The environmental analysis shall include proposed methods of mitigating surface and groundwater impacts, and maximizing recharge.

Design Standards

a. Design and construction shall reduce, to the extent possible, the following:

-- encroachment within any wetland or floodplain,

-- volume of cut and fill,

-- area over which existing vegetation will be disturbed, especially if within 200 feet of a river, wetland or waterbody or in areas having a slope of more than 15 percent,

-- number of trees removed having a diameter over 12" dbh,

-- extent of waterways altered or relocated, and

-- dimensions of paved areas (including streets) except as necessary to safety and convenience, especially in aquifer/recharge areas.

b. Design shall maximize, to the extent possible, maintenance within the subdivision of runoff and vegetative cover equivalent to conditions before development.

c. Easements: Where a subdivision is traversed by a water course, drainage way, channel or stream, the board shall require a storm water easement or drainage right-of-way of adequate width and proper side slope as determined by the town engineer to conform substantially to the lines of such water course, drainage way, channel or stream, and to provide access for construction or other necessary purposes. In no case shall the width be less than twenty (20) feet or the side slopes be steeper than three (3) horizontal on one (1) vertical.

d. Pollution control devices: Within aquifer or recharge areas, provisions for contaminant removal shall be made employing detention basins with subsurface drains or perforated risers, oil and grit separator catchbasins, or other appropriate devices. Sanitary sewer pipes shall be reinforced with sealed joints.

e. Curbing: Curb and gutter may be eliminated along certain roadways, when drainage is provided in swales which are designed to reduce the rate of runoff, restore and/or supply needed water to vegetation in the street right-of-way.

f. Trees: Street trees of nursery stock shall be planted on each side of the street in a subdivision, except where the definitive plan shows

trees along the ways which are healthy and adequate, which shall be retained. Street trees shall be located outside of the right-of-way or at the discretion of the board within the unpaved portion of the right-of-way approximately at forty foot (40') intervals; shall be at least twelve feet (12') in height; two inches (2") in caliper measured four feet (4') above the approved grade (dbh); shall be planted each in at least one-half (½) cubic yard of topsoil, unless otherwise required by the tree warden and/or town engineer; and be not closer than five (5') nor more than twenty feet (20') from said right-of-way line unless otherwise approved by the board. Trees shall be properly planted, wrapped and guyed to insure their survival. The developer will be liable for all trees so planted as to their erectness and good health after planting and until the release of all guarantees.

Except as otherwise provided, all cut bankings shall be planted with a low growing shrub or vine and wood chipped to a minimum depth of six inches (6") or seeded with a deep-rooted perennial grass to prevent erosion.

Other landscaping along ways may be required by the board.

g. Road Salt: The board may limit the use of deicing chemicals on ways located over aquifer and recharge areas for existing or potential drinking-water supplies or where runoff may affect drinking water reservoirs or wells.

h. Protection of Natural Features: All natural features, such as trees, wooded areas, water courses, scenic points historic spots, shall be preserved as much as possible. Any clearance, backfilling, cutting, thinning or other disturbance to trees twelve inches (12") or over in diameter measured four feet (4') above finished ground level, located within the minimum front setback distance shall be prohibited unless deemed both proper by the board and not in conflict or contradiction to the intent of Section 3(c). Any such proposed clearance shall be shown on the plan and written reasons therefore may be requested by the board. Tree wells or retaining walls should be installed when and as requested by the town engineer for suitable grading around trees. Tree wells or retaining walls shall be of such design to meet the standards as set fourth in the Tree Experts Manual or some similar publication.

i. Open Space: The board may require the plan to show a park or parks, suitably located for playground or recreation purposes or for providing light and air. The park or parks shall not be unreasonable in area in relation to the land being subdivided and to the prospective uses of such land and shall be at least equal to one (1) acre of land for each twenty (20) single family dwelling units or fraction thereof shown on the plan. For all non-residential subdivisions, the park shall be equal to three (3) times the floor area of all other dwelling

units, and ten (10) percent of the land area. The board may, by appropriate endorsement on the plan, require that no building be erected upon such park or parks without its approval for a period of three (3) years. Each area reserved for such purpose shall be of suitable area, dimensions, topography, and natural character for the purpose of a park and/or playground. The area or areas shall be so located as to serve adequately all parts of the subdivision as approved by the board. The board may require that the area or areas reserved shall be located and laid out so as to be used in conjunction with similar areas of adjoining subdivision or of probable subdivisions.

j. Sediment Control: In order to reduce erosion accompanying the installation of ways, utilities and drainage, and the resultant pollution of streams, wetlands and natural drainage areas, the applicant shall submit a sediment control plan, including control methods such as berms, dikes, detention ponds, mulching, and temporary sodding.

k. Drainage: Storm drains, culverts, and related facilities shall be designed to permit the unimpeded flow of all natural-water courses, to ensure adequate drainage at all low points along streets, to control erosion and to intercept storm-water runoff along streets at intervals reasonably related to the extent and grade of the area being drained. To the maximum extent feasible, storm water shall be recharged rather than piped to surface water. Peak stream flows and runoff at the boundaries of the development in a 100-year frequency storm shall be no higher following development than prior to development in aquifer-recharge areas and no more than five percent higher in other areas.

l. Lot Drainage: Lots shall be prepared and graded consistent with drainage into the subdivision and in such a manner that development of one shall not cause detrimental drainage on another or on areas outside the subdivision, to the extent permitted by law. If provision is necessary to carry drainage to or across a lot, an easement or drainage right-of-way of a minimum width of twenty feet (20') and proper side slopes shall be provided.

m. Design Method: Design shall be based upon the modified soil cover complex method and ULI Residential Storm Water Management, 1975, and Guidelines for Soil and Water Conservation in Urbanizing Areas of Massachusetts (SCS USDA 1975), unless alternative methods or sources are approved by the planning board. Water velocities in pipes and gutters shall be between two (2) and ten (10) feet per second, and not more than five (5) feet per second on ground surfaces.

Where the water table is not too high and where the soil is reasonably permeable, drainage may feature swales, detention ponds and multi-use areas, as described in the following section, "Methods for Controlling Peak Discharges from Urbanizing Areas" (SCS Guidelines) and described more fully in "Water Resources Protection Measures -- in Land Development" -- A Handbook of the University of Delaware Water Resources Center, Newark Dec. 1974 (prepared for the Office of Water Resources Research, U.S. DOI). Open drainage systems as described in this publication may be required for recharging groundwater provided that runoff is not seriously polluted.

MODEL SITE PLAN REVIEW BYLAW

(Prepared by the Metropolitan Area Planning Council)

MODEL SITE-PLAN-REVIEW BYLAW

The zoning bylaw/ordinance is hereby amended by adding the following section:

Section · : SITE PLAN REVIEW

A. Purpose

The purpose of site plan review is to ensure that the design and layout of certain developments permitted as of right (or by special permit) will constitute suitable development and will not result in a detriment to the neighborhood or the environment.

In considering a site plan the (Special Permit Granting Authority (SPA)) shall assure:

a. Protection of adjacent areas against detrimental or offensive uses on the site by provision of adequate surface water drainage, buffers against light, sight, sound, dust, and vibration, and preservation of light and air;

b. convenience and safety of vehicular and pedestrian movement within the site and in relation to adjacent areas;

c. adequacy of the methods of disposal for wastes;

d. protection of environment features on the site and in adjacent areas;

e. adequate protection to prevent pollution of surface waters and groundwater.

B. Projects Requiring Site Plan Review

No building, other than a (single-family or two-family dwelling or building accessory to such dwelling) shall be erected or externally enlarged by more than 10 percent of gross floor area (or, no business or industrial building shall be erected or externally enlarged, and no business or industrial use shall hereafter be established or expanced in ground area) except in conformity with a site plan bearing an endorsement of approval from the (SPA). The (SPA) shall adopt regulations for carrying out its duties under this section.

C. Procedure

1. An applicant for site plan review under this section shall file with the (SPA) ___ copies of each of an application and a site plan. Unless this requirement is waived by the (SPA), the site plan shall be prepared by an engineer, architect, or landscape architect.

2. The site plan shall show all existing and proposed buildings, existing and proposed contour elevations, structures, parking spaces, driveway

openings, driveways, service areas, facilities for sewage, refuse and other waste disposal and for surface-water drainage, wetlands, surface water, areas subject to the 100-year flood, maximum groundwater elevation, location of aquifers, private or public wells and drinking-water supplies in relation to the site, and landscape features such as fences, walls, planting areas, walks, and lighting, both existing and proposed. The site plan shall also show the relation of the above features to adjacent ways and properties. The site plan shall also show all contiguous land owned by the applicant or by the owner of the property which is the subject of the application.

3. The applicant shall submit such material as may be required regarding measures proposed to prevent pollution of surface or groundwater, soil erosion, increased runoff, and flooding.

4. The applicant shall submit such materials as may be required regarding design features intended to integrate the proposed new development into the existing landscape, to enhance aesthetic assets, and to screen objectionable features from neighbors.

5. The applicant shall submit such material as may be required regarding the projected traffic flow patterns into and upon the site for both vehicles and pedestrians and an estimate of the projected number of motor vehicle trips to and from the site for an average day and for peak hours.

6. The (SPA) shall, within five days of receipt, transmit to the planning board, the building inspector and the conservation commission copies of the application and site plan. The boards receiving these copies shall have up to 40 days to make recommendations to the (SPA).

7. The (SPA) shall hold a public hearing within 45 days of receipt of an application and shall take final action within 90 days from the time of hearing, as provided in G.L. ch. 40a, s 9 and 11, (and in section ___ of this bylaw/ordinance, relating to special permit procedures. Such final action shall consist of either (1) a finding and determination that the proposed project will constitute a suitable development and will not result in detriment to the neighborhood or the environment or (2) a written denial of the application stating the reasons for such denial. Approval may be made subject to conditions, modifications and restrictions as the (SPA) may deem necessary; and any construction, reconstruction, alteration or addition shall be carried on only in conformity to such conditions, modifications or restrictions and in conformity with the application and the site plan.

8. (If the planning board is the special permit authority under this section, it shall, insofar as practical, adopt regulations establishing procedures for submission of a combined plan and application

which shall satisfy this section and the board's regulations under the Subdivision Control Act.)

9. Projects reviewed by other town boards are exempt as follows: _____

_____.

D. Criteria for Approval

1. The site plan shall show adequate measures to prevent pollution of surface or groundwater soil erosion, increased runoff, changes in groundwater level, and flooding.

2. The development design shall be integrated into the existing landscape to enhance aesthetic assets and to screen objectionable features from neighbors.

3. The site plan shall show adequate measures to prevent traffic congestion and dangerous access within the site and onto existing town ways.

4. The site plan shall protect adjacent areas againsts detrimental or offensive uses on the site by providing adequate surface-water drainage, buffers against light, sound, dust, noise, and vibration.

5. The site plan shall show adequate methods for disposal of wastes.

All site plans complying with this section and which do not tend to impair the health, safety, convenience and welfare of the inhabitants of the town in general shall be approved.

APPENDIX E

Massachusetts Department of Environmental Quality Engineering

Division of Water Supply

Technical Assistance Program for Groundwater Communities

Daniel S. Greenbaum
Commissioner

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Division of Water Supply
One Winter Street, Boston, Mass. 02108

COMMUNITY TECHNICAL ASSISTANCE
(617) 292-5534

Program Description
January 1989

INTRODUCTION

Statewide efforts to manage and protect groundwater depends on effective planning and land use control at the community level. DEQE's Groundwater Protection Strategy recognizes that the community role in groundwater protection is vital and should be enhanced through State assistance programs.

The Division of Water Supply Technical Services Section offers a variety of technical, planning and educational resources which are intended for use in communities. The Boston office houses a resource library which contains planning references, technical reports, water supply studies, community technical assistance files, and bylaws related to water supply protection. Our resources are described below.

I. TECHNICAL PLANNING ASSISTANCE

The technical assistance staff is available to meet with individual communities and multi-town collaboratives to discuss local strategies for water supply protection. Guidance is offered on:

- o grant applications for aquifer land acquisition;
- o DEQE's data bank of information on water quality, quantity, and hydrogeologic setting;
- o local government powers to regulate land use for groundwater protection;
- o suggested land use activities for primary recharge areas for public water supply wells; and
- o selecting and implementing appropriate groundwater protection measures for your community.

Original on Recycled Paper

II. WATER SUPPLY PROTECTION ATLAS

Statewide environmental data is consolidated into the Water Supply Protection Atlas which consists of 4 transparent overlays for 176 U. S. Geologic Survey (USGS) quadrangle maps. The USGS maps portray topographic features such as land surface contours, rivers, lakes, and wetlands, as well as roads, buildings, and other man-made features. The four overlay maps supply information on water sources, waste sources, aquifer information, and drainage basin boundaries. These overlays, combined with the USGS quadrangle base map, provide a means of associating water supplies with the geologic resources and possible sources of contamination.

The Water Supply Protection Atlas is available at the DEQE offices in Boston, Woburn, Springfield, Worcester and Lakeville. In 1984, the Department provided overlays to each municipality in Massachusetts. The Atlas is accompanied by a handbook that explains the maps and their use in local planning.

III. GROUNDWATER SLIDE TAPE PROGRAMS

The following slide-tape programs produced by the New England Interstate Water Pollution Control Commission (NEI), are available on a limited basis from the DEQE Boston Office:

A. Out-of-Sight - Not-out-of-Danger - This program provides general information about groundwater movement, contamination, and protection techniques.

B. Here Lies the Problem...Leaking Underground Storage Systems This program explains the impact of leaking underground storage tanks on groundwater and public health.

IV. LOCAL BYLAWS AND REGULATIONS FILE

To assist communities in establishing up-to-date and effective local groundwater protection measures, the Division maintains a file of existing and proposed bylaws and regulations adopted by individual communities and model bylaws developed by regional planning agencies and the Conservation Law Foundation of New England, Inc.. A summary of adopted groundwater protection measures, listed by town, is also available.

V. PUBLICATIONS

A. DEQE - Water Supply Programs

This flyer includes a description of the various state grant and assistance programs administered by the Division of Water Supply.

B. Handbooks available at DEQE Boston

(1) Erosion and Sedimentation Control Guidelines

These guidelines will aid planning board members, enforcement officials, developers, and engineers involved in erosion and sediment producing activities to improve their understanding of the erosion process and their selection of appropriate control measures.

(2) Groundwater Monitoring Handbook

Currently, groundwater monitoring is carried out on a site-by-site basis, with responsibilities distributed among several different agencies. This handbook reviews existing monitoring programs and current agency responsibilities. It describes information needs, data management needs and monitoring techniques.

(3) Handbook of Treatment Technologies for Contaminated Groundwater

The purpose of this handbook is to inform state, regional, and local officials about the technologies currently available to treat organically contaminated groundwater and to provide them with the means to understand and evaluate groundwater supply treatment proposals in terms of their suitability, effectiveness and cost.

(4) Road Salts and Water Supplies: Best Management Practices

To prevent further contamination of groundwater sources due to road salts, DEQE, in cooperation with the Massachusetts Department of Public Works and the Pioneer Valley Planning Commission developed a list of Best Management Practices for road salt use. These address the storage, handling and application of road salts and the disposal of salt-laden snow. Recommended practices include preventive, mitigative, or restorative techniques. Published in August 1981, this twelve page handbook was distributed to appropriate state agencies and towns with sodium in municipal water supplies exceeding the 20 mg/l state drinking water standard.

(5) Pesticide and Drinking Water: A Public Information Package

This guidebook directs private well owners to certified laboratories capable of analyzing drinking water for certain pesticides. Health information, treatment techniques, and drinking water guidelines are also provided.

(6) Water Supply Protection Atlas Handbook

This guide presents sources of data and explains in detail the key and numbering system used on the Water Supply Protection Atlas. The handbook is comprised of four sections which correspond with each of the four overlays: Water Sources, Waste Sources, Aquifer Information, and Drainage Basins.

TO RECEIVE A COPY OF A PUBLICATION, SEND A WRITTEN REQUEST TO THIS DIVISION. PLEASE LIMIT REQUESTS FOR HANDBOOKS TO TWO PER ORGANIZATION.

C. HANDBOOKS AVAILABLE AT THE STATE HOUSE BOOKSTORE:

(1) Groundwater Quality and Protection..A Guide for Local Officials

To assist local officials in managing their groundwater resources, this handbook discusses principles of groundwater hydrology, common contaminants and their sources, and local regulatory and management options. A discussion of groundwater law and a list of federal and state agencies providing groundwater assistance are also included. This handbook has been distributed to all cities and towns and to government agencies with groundwater programs. ($5.60 plus $2.05 delivery charge.)

(2) Massachusetts Hydrogeologic Information Matrix

The Massachusetts Hydrogeologic Information Matrix details all of the currently available sources of information for Massachusetts from the United States Geological Survey on subsurface geology and hydrology. References include: USGS geologic quadrangle maps which have been completed as well as those maps in the process of compilation; hydrologic and USGS cooperative project bulletins; and miscellaneous USGS investigations. ($6.85 plus $2.05 delivery charge.)

(3) Cape Cod Aquifer Management Project: Final Report. 1988 EPA 901/3/-88-006. Cost $9.40, $1.75 for mailing and handling.

Make checks out to the Commonwealth of Massachusetts and send to:

State House Bookstore
Room 116, State House
Boston, MA 02133
(617) 727-2834

b/jhgwta or akgwta

APPENDIX F

Cape Cod Aquifer Management Project (CCAMP)

DOCUMENTS AVAILABLE

February , 1989

(An asterisk indicates documents not included in the final report.)

Except as otherwise noted, all CCAMP documents listed below will be available from the National Technical Information Service (NTIS) after February, 1989. Contact NTIS directly at the following address:

National Technical Information Service
U. S. Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161
(703) 487-4650

General

*1. "Cape Cod Aquifer Management Project Description". November 1985.

2. "Cape Cod Aquifer Management Project: Final Report". 1988. EPA 901/3-88-006. (Final Report includes the following item numbers from this CCAMP list of documents: 4-11; 16-19). NTIS No. PB89 106298/AS; $19.95 paper, $6.95 microfiche; Also available from the State House Bookstore, Statehouse, Room 116, Boston, MA, Cost $9.40, $1.75 for mailing and handling.

*3. "Cape Cod Aquifer Management Project: Executive Summary". 1988. EPA 901/3-88-003.

*4. "The Cape Cod Aquifer Management Project: A Multi-Agency Approach to Groundwater Protection" by T. Gallagher and S. Nickerson. July 1986. In Proceedings of the Third Annual Eastern Regional Ground Water Conference, NWWA, Springfield, MA. pp. 116-135. Available from your technical library or from the National Water Well Association, 6375 Riverside Drive, Dublin, OH 43017.

*5. "A Resource-Based Approach to Groundwater Protection" by Lee Steppacher and Tara Gallagher. May 1988. Environment, Volume 30(4), pp.4,45. (Available from your technical library).

Institutional Recommendations (Items 6-13 available from NTIS as a package):

6. Cape Cod Aquifer Management Project Recommendations, Enhanced Groundwater Protection in Landfills. August 1986.

7. Cape Cod Aquifer Management Project Recommendations, Construction Grants, Groundwater Discharge Permit Program, and Groundwater Classification. December 1986.

8. Cape Cod Aquifer Management Project Recommendations, Water Supply Planning. December 1986.

9. Cape Cod Aquifer Management Project Recommendations, Underground Storage Tank. October 1987.

10. Cape Cod Aquifer Management Project Recommendations, Septage Management. December 1987.

11. Cape Cod Aquifer Management Project Recommendations, Hazardous Materials Use and Disposal. December 1987.

12. Cape Cod Aquifer Management Project Recommendations, Private Well Protection. October 1987.

13. Cape Cod Aquifer Management Project Recommendations, Pesticide Recommendations. January 1988.

Technical Documents

*14. "A Mass-Balance Nitrate Model for Predicting the Effects of Land Use on Groundwater Quality in Municipal Wellhead Protection Areas" by M. Frimpter, J. Donohue IV, and M. Rapacz. June 1988. 50 pp. (Provides managers with an easily understood methodology and the relevant associated data for application of this formula.).

*15. "Guide to Contamination Sources for Wellhead Protection" by K. Noake. 1988. 75 pp. EPA 901/3-88-004. (This handbook provides detailed information on common land uses and associated contaminants and their environmental fate.).

16. Water-Table Elevations: Eastern Barnstable, Massachusetts, May 11-13, 1987" by D. Heath and E. Mascoop. October 1987.

*17. Locating Available Water-Table Observation Wells". October 1987. Available from Cape Cod Planning and Economic and Development Commission, First District Court House, Barnstable, MA 02630. (Describes methodology to follow for developing a water-table map utilizing existing observation wells.)

*18. "Demonstration of the Use of Three Dimensional Groundwater Flow Modeling and Particle Tracking to Delineate Zones of Contribution to Public Supply Wells, Cape Cod, MA" by USGS. Available May 1, 1990. (Three-year study suggested by CCAMP utilizing numerical modeling in Barnstable and Eastham.). (Available in 1990 from the Books and Open-Files Reports Section; Box 25425, Federal Center; Denver, Colorado 80225.)

Items 19-21 will be available as a package from National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161 after October 1, 1988.

19. "Evaluation of Approaches to Determine Recharge Areas for Public Supply Wells " CCAMP Aquifer Assessment Committee. April 1986. (Summarizes the group's evaluation of Zone II delineations in the study area.)

20. "Hydrogeologic Considerations of Zone of Contribution Methods Used by Cape Cod Planning and Economic Development Commission and SEA Consultants, Inc. For Public Supply Wells in Barnstable, Massachusetts". May 1986. (Detailed examination of necessary data for Zone II delineation and discussion of methods of data reduction.)

21. "Quality Assurance of Groundwater Models Through Documentation" by John Donohue, IV. June 1986. (Discusses the necessary documentation which should accompany all groundwater modeling efforts.)

Zone II Inventory

*22. "Cape Cod Aquifer Management Project: Land Use Risks, Impacts on Water Quality, and Methods of Analysis" by Gabrielle Belfit. May 1987. Presented at the American Water Resources Symposium on Monitoring, Modeling and Mediating Water Quality, in Syracuse, N.Y., 14 pp. (Available from your technical library)

*23. "The Management of Toxic and Hazardous Materials in a Zone of Contribution on Cape Cod" by Tara. Gallagher and Lee Steppacher. July 1987. In Proceedings of the FOCUS on Eastern Regional Ground Water Issues: A Conference, July 14-16, 1987, Burlington, Vt. pp. 13-41. (Available from your technical library)

Geographic Information Systems (GIS)

*24. Cape Cod Aquifer Management Project. 1988. "Demonstration of a Geographic Information System for Ground Water Protection. EPA 901/3-88-005.

*25. "Assessing Risk to Water Quality at Public Water Supply Sites, Cape Cod, Massachusetts" by Julio Olimpio, Elizabeth Flynn, and Saiping Tso. Water Resources Investigation Report. In Preparation (Available after January 1, 1989 from the USGS, Books and Open-Files Reports Section, Box 25425, Federal Center, Denver, Colorado 80225.)

Bibliography

*26. "CCAMP Bibliographies: Publications and Maps". May 1988. Compiled by EPA Region 1 Library. EPA 901/3-88-002.